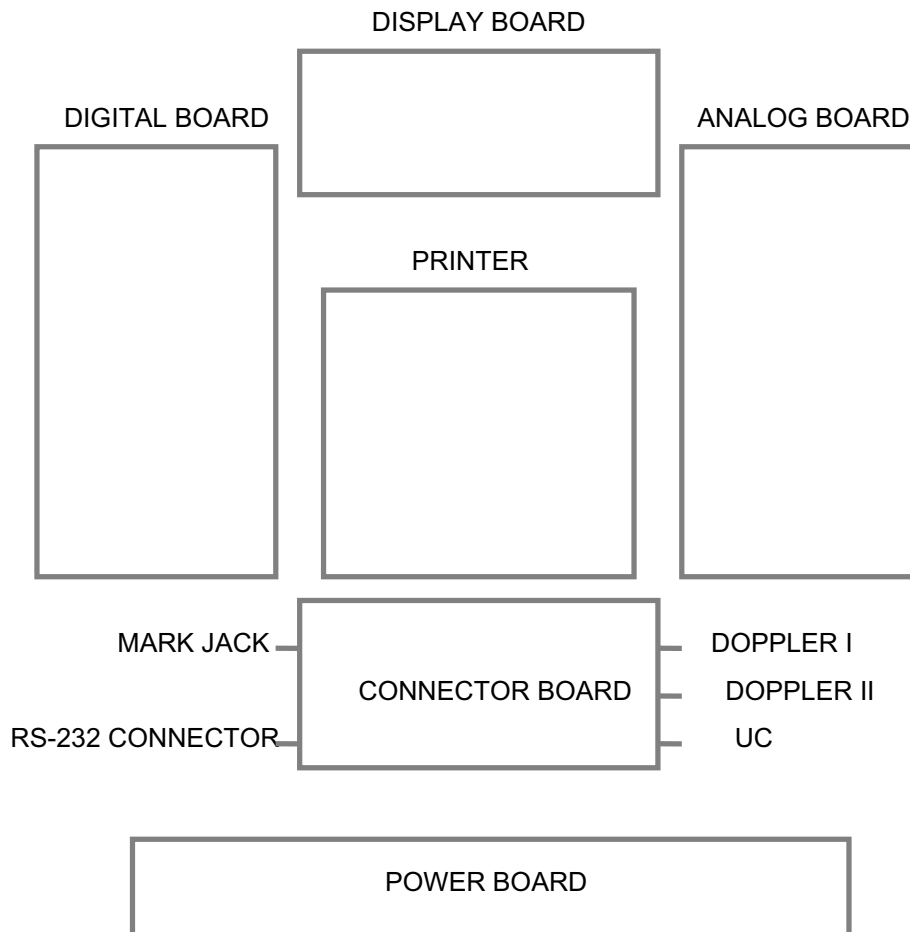
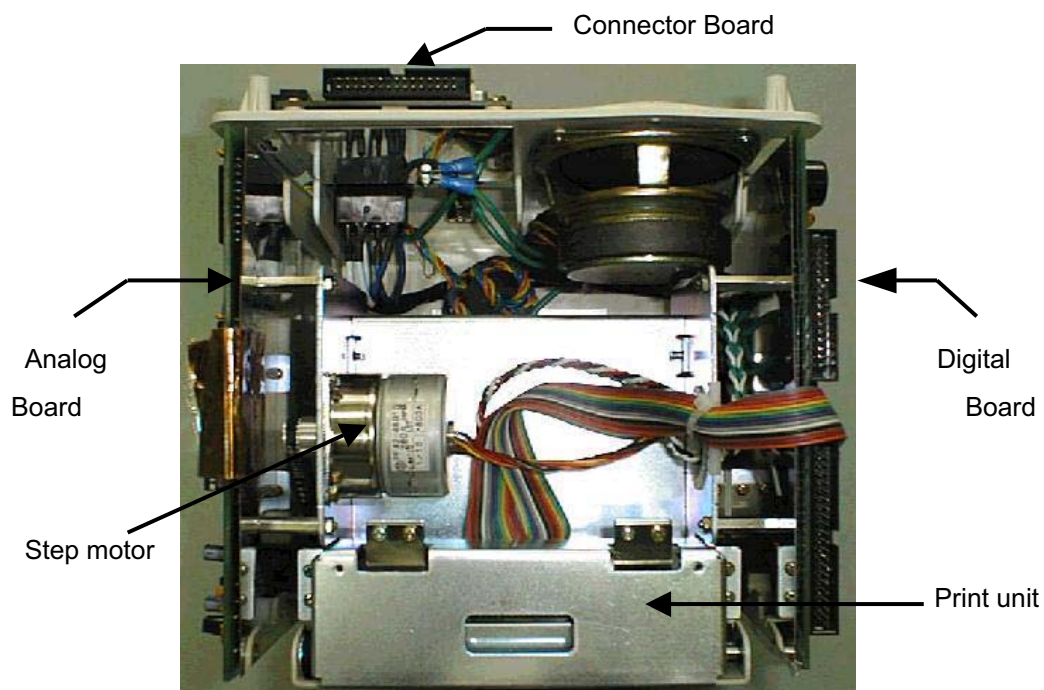


# 1. The structure of IFM-500

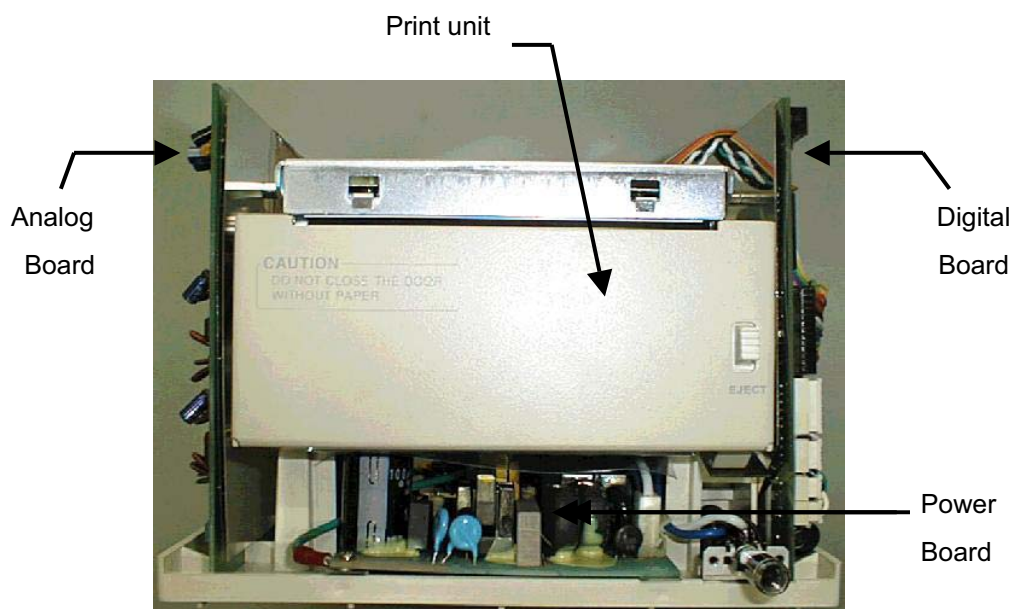
## 1) CONFIGURATION



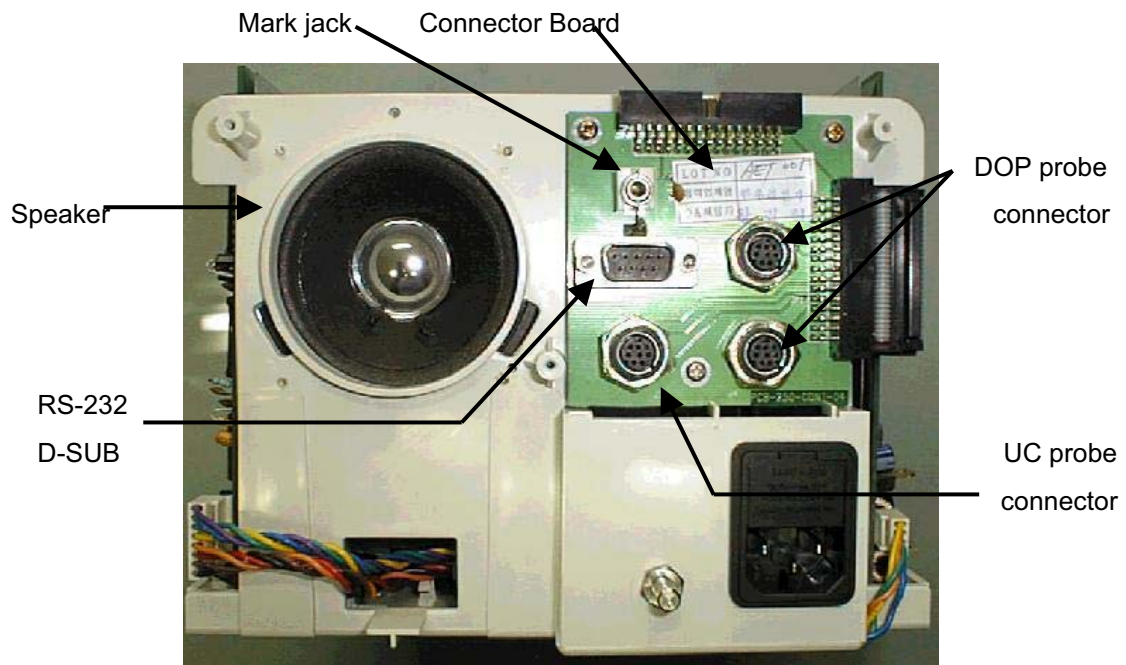
## -TOP VIEW



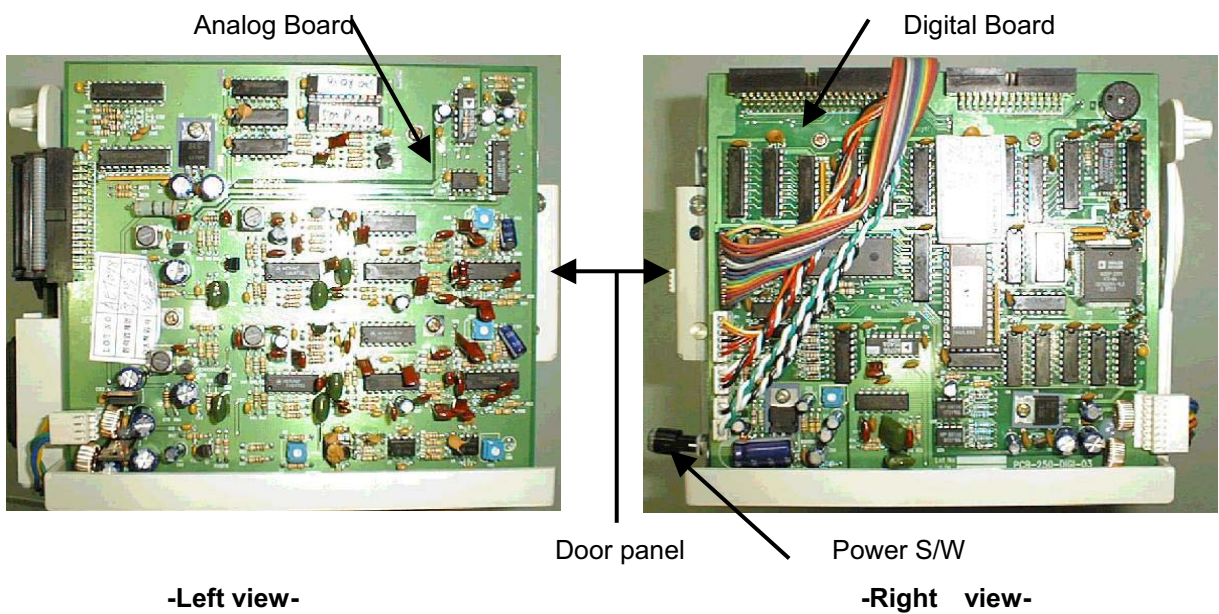
## -FRONT VIEW



-BACK VIEW

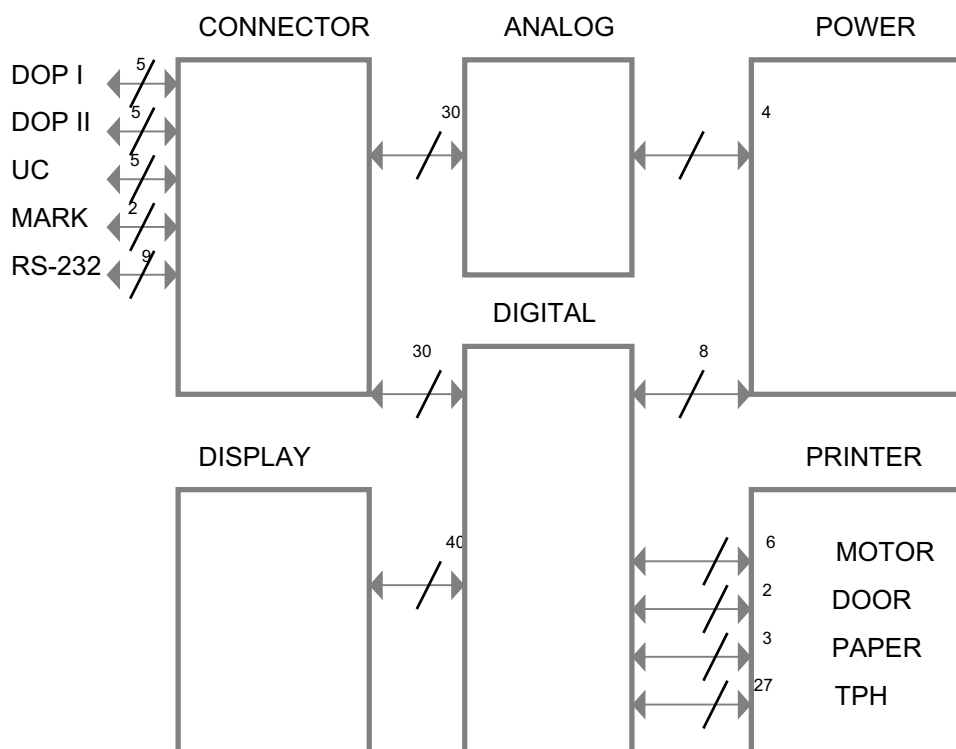


-SIDE VIEW



## 2) CABLE and POWER CONNECTION

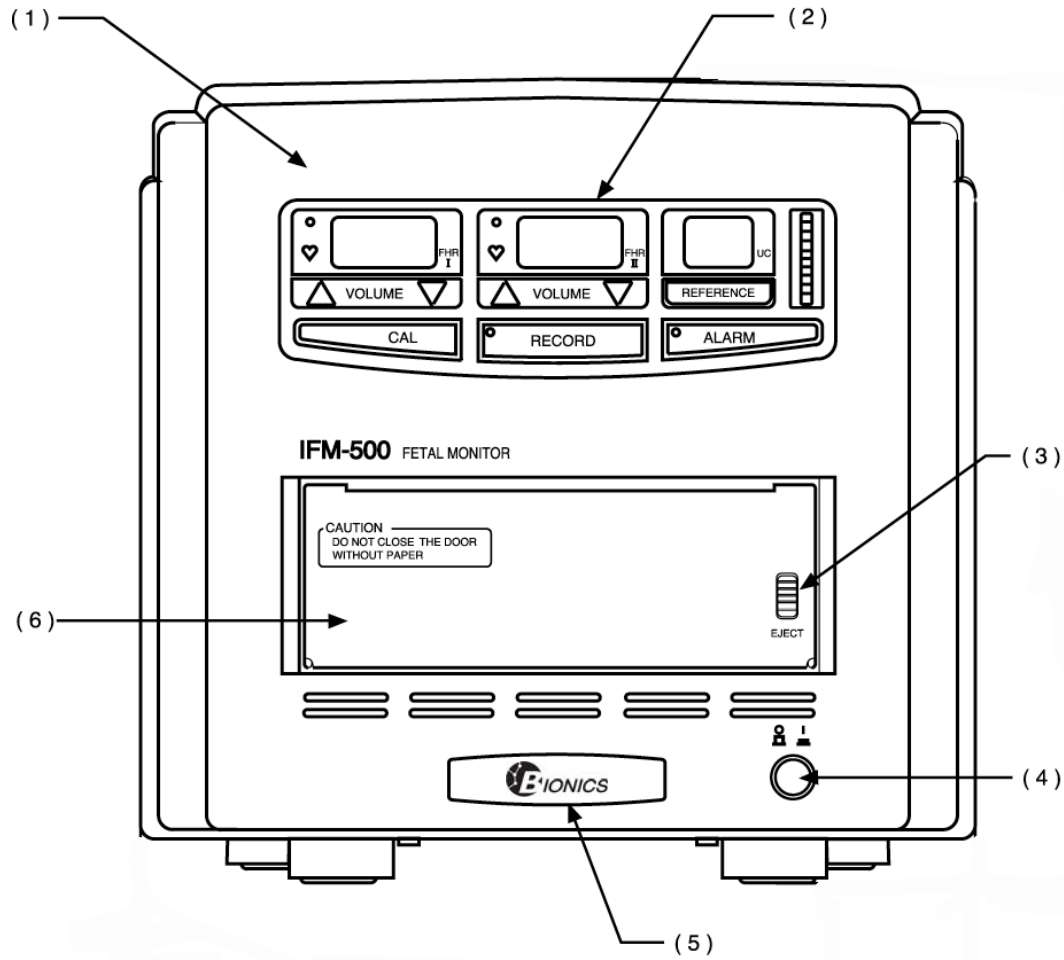
Overall system connection status of cable and power line.



## 3) EXPLODED VIEW

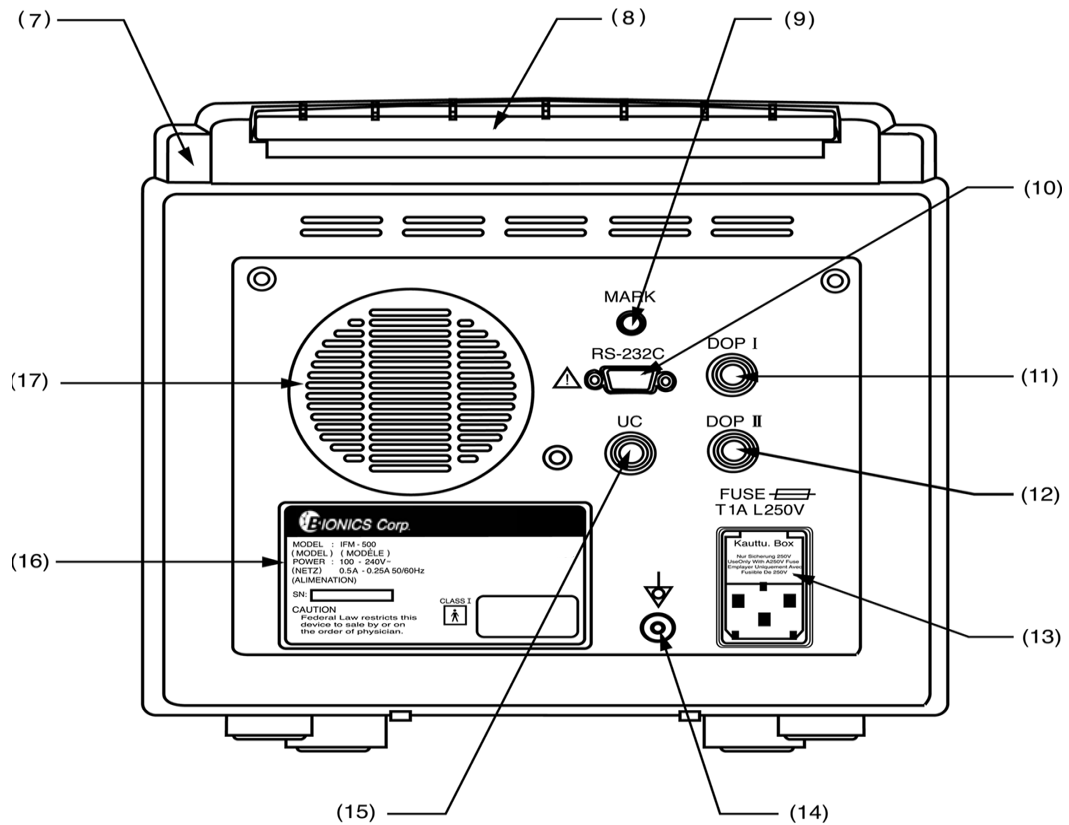
- A. See attached drawings.

-FRONT VIEW



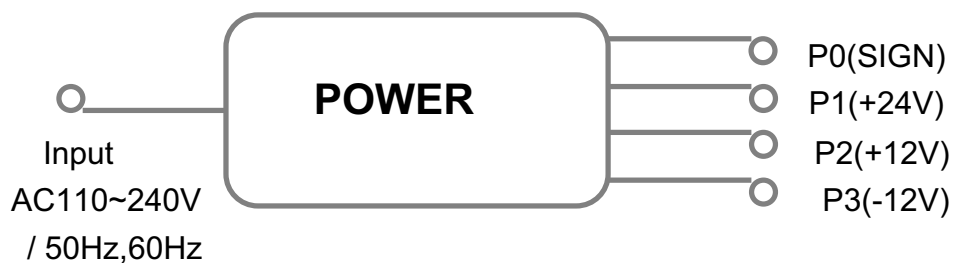
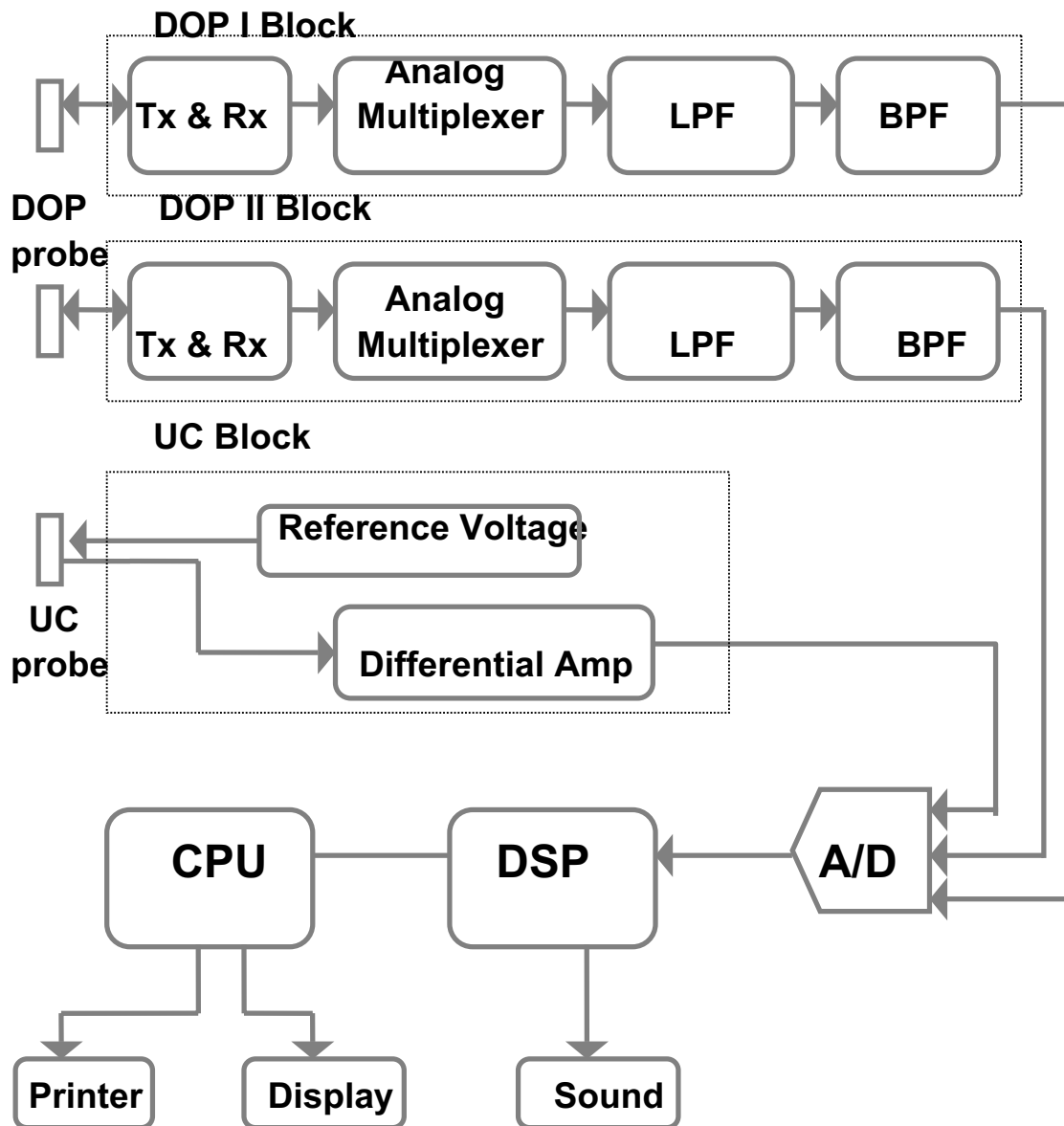
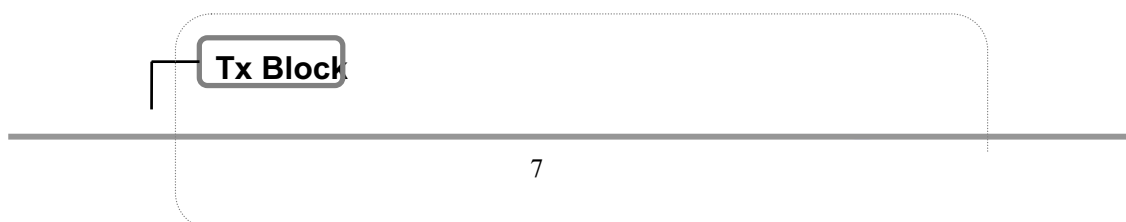
- (1) FRONT COVER
- (2) OP PANEL
- (3) OPEN KNOB
- (4) POWER SWITCH
- (5) LOGO LABEL
- (6) DOOR PANEL

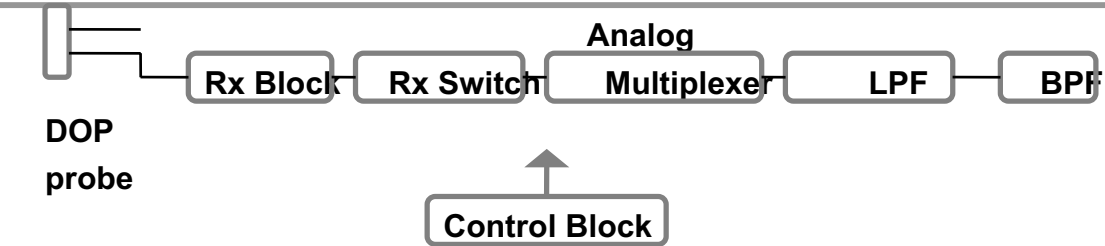
-BACK VIEW



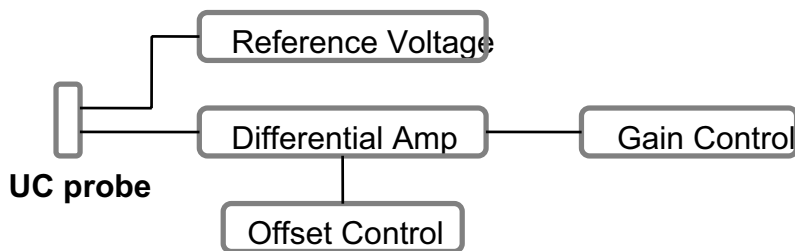
- (7) REAR COVER
- (8) LIFT HANDLE
- (9) EVENT MARKER SOCKET
- (10) SERIAL PORT
- (11) DOP I PROBE PORT
- (12) DOP II PROBE PORT
- (13) POWER INLET
- (14) PROTECT GROUND
- (15) UC PROBE PORT
- (16) MAIN LABEL
- (17) SPEAKER

## 2.BLOCK DIAGRAM

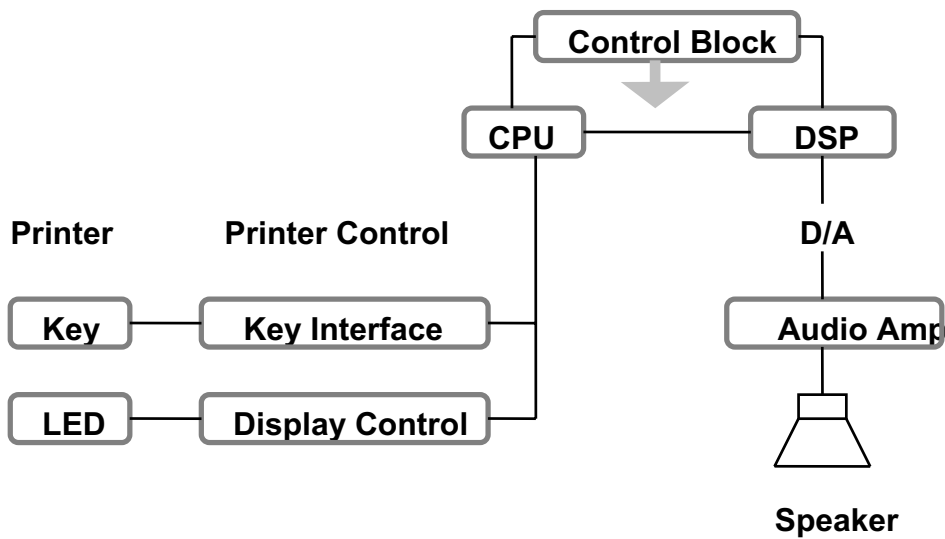
**1) Overall Block Diagram****2) Doppler Block Diagram**



### 3) UC Block Diagram



### 4) Digital Block Diagram



## 3. BOARDS OF IFM-500

### 3.1 ANALOG BOARD

Generated Exciting Pulse activates Ultrasound Transducer and process acquired signal by

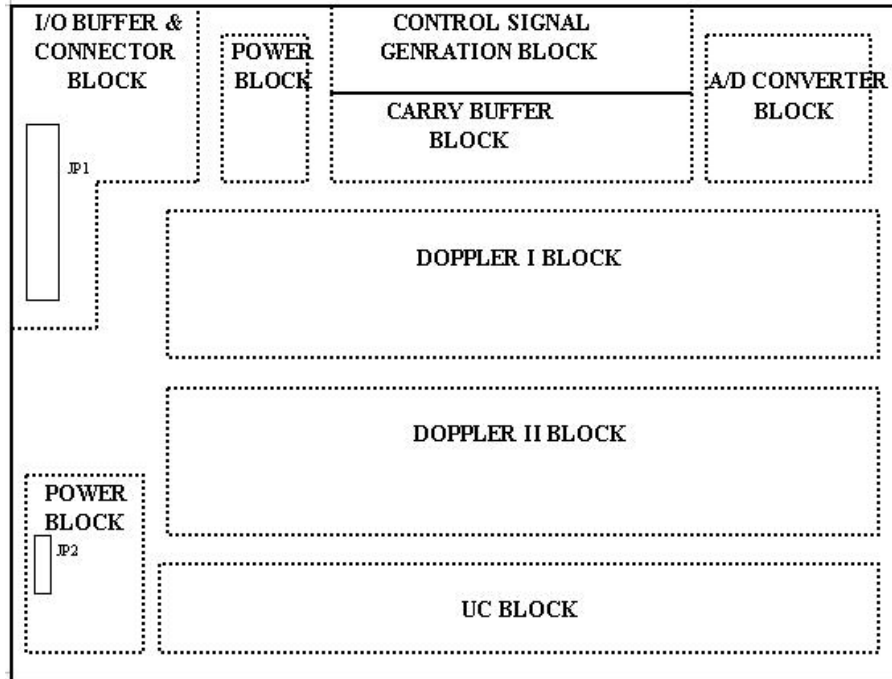


means of Doppler signal.

The pressure which is sensed by strain gauge is transferred into electrical signal.

Transfer received signal into digital signal and transmit data to digital board.

#### CONFIGURATION



#### 1) I/O BUFFER and CONNECTOR BLOCK

Conduct buffering both signal from analog Board Unit to Connector Board Unit and from

Connector Board Unit to Analog Board Unit.

-Following table indicates the pin description of Analog I/O connector.

Table of Analog I/O Connector Pin Definition

Pin #	Pin Name	Description	Pin #	Pin Name	Description
1	DOP2G	Doppler 2 Ground	2	-UCIN	Minus UC Input
3	DOP2S	Doppler 2 Signal	4	GND	Ground
5	-UCOUT	Minus UC Output	6	GND	Ground
7	AUCID	Analog UC Identity	8	APID2	Analog Doppler 2 identity
9	+UCOUT	Plus UC Output	10	+UCIN	Plus UC Input
11	DOP1G	Doppler 1 Ground	12	DOP1S	Doppler 1 Signal
13	APID1	Analog Doppler 1 identity	14	GND	Ground
15	UCID	UC Probe Identity	16	PID1	Doppler 1 identity
17	PID2	Doppler 1 identity	18	GND	Ground
19	ADOUT	A/D Output	20	GND	Ground
21	ADCLK	A/D Clock	22	GND	Ground
23	BUSY	A/D State Signal	24	ASWA1	Analog Switch Address 1
25	ASWA0	Analog Switch Address 0	26	PRBCS2	Probe Chip Selection 2
27	PRBCS1	Probe Chip Selection 1	28	PRBCS0	Probe Chip Selection 0
29	GND	Ground	30	CLK8M	8MHz Clock

## 2) CONTROL SIGNAL GENERATION BLOCK

The analog control signal which is 8MHz clock and probe chip selection which is 0, 1, 2 are generated.

### Module Function

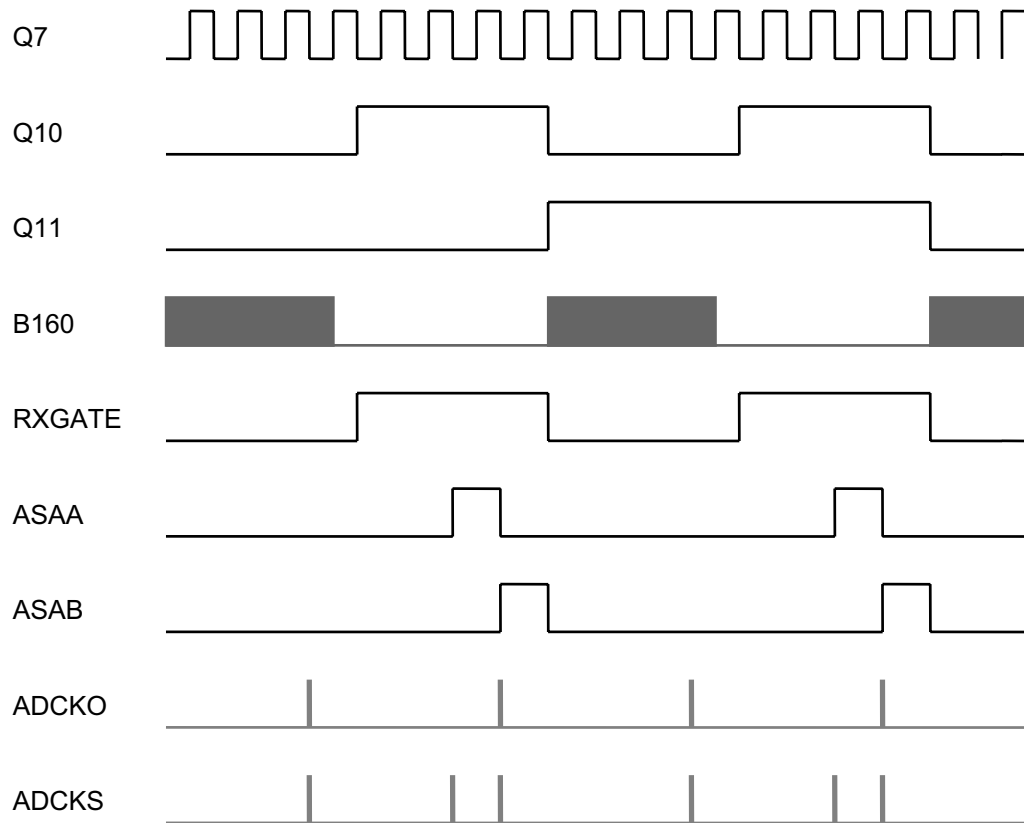
Module Name	Module Description
Clock Generator	Divide 8MHz of Main Clock into needed clock for the Analog board.
Timing Signal Generator	Transfer input clock into timing signal for analog board.
Control signal Generator	Using the Digital Board control signal (prbcs0,prbcs1) from Timing signal and Connector Board, generate necessary control signal for analog board.

### Basic timing signal generation (PAL : U13)

#### i) Pin definition

Input			Output		
Pin #	Pin Name	Description	Pin #	Pin Name	Description
1	Q1	2MHz	19	B160	Burst
2	Q4	250KHz	17	RXGATE	Receive Enable
3	Q5	125KHz	16	ASAA	Analog S/W Address A
4	Q6	62.5KHz	15	ASAB	Analog S/W Address B
5	Q7	31.25KHz	14	ADCKO	A/D Clock Operation
6	Q8	15.625KHz	13	ADCKS	A/D Clock Search
7	Q9	7.8125KHz	-	-	-
8	Q10	3.90625KHz	-	-	-
9	Q11	1.953125KHz	-	-	-

## ii) Timing diagram



Basic Control signal generation (PAL : U14)

## i) Pin definition

Input			Output		
Pin #	Pin Name	Description	Pin #	Pin Name	Description
1	PCS0	Probe Chip Selection 0	19	TX1DRV	Dop I Drive Pulse
2	PCS1	Probe Chip Selection 1	18	TX2DRV	Dop II Drive Pulse
3	PCS2	Probe Chip Selection 2	17	RXG1	Dop I Receive Enable
4	B160	Burst	16	RXG2	Dop II Receive Enable
5	Q11	1.953125KHz	15	SWA0	Switch Address Bit 0
6	RXGATE	Receive Enable	14	SWA1	Switch Address Bit 1

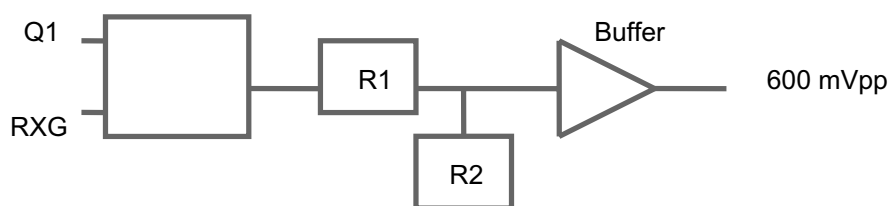
	ASAA	Analog S/W Address A	12	ADCK	A/D Clock
8	ASAB	Analog S/W Address B	-	-	-
9	ADCKO	A/D Clock Operation			
11	ADCKS	A/D Clock Search	-		-

ii) Definition of probe chip selection mode

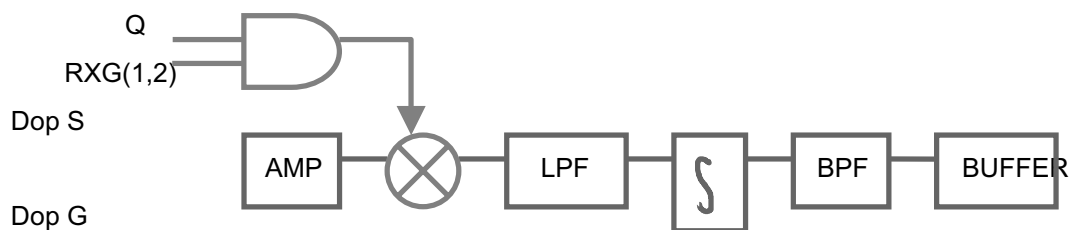
PCS 2	PCS 1	PCS 0	Mode Description	
			Attached Probe	Operation Description
O	O	O	Not Defined	
O	O	I	Doppler I	Dop I
O	I	O	Doppler II	Dop II
O	I	I	Not Defined	
I	O	O	Doppler I, Doppler II	Dop I, Dop II : Search
I	O	I	Doppler I, Doppler II	Dop I (Dop II : Search)
I	I	O	Doppler I, Doppler II	Dop II (Dop I : Search)
I	I	I	Doppler I, Doppler II	Dop I, Dop II

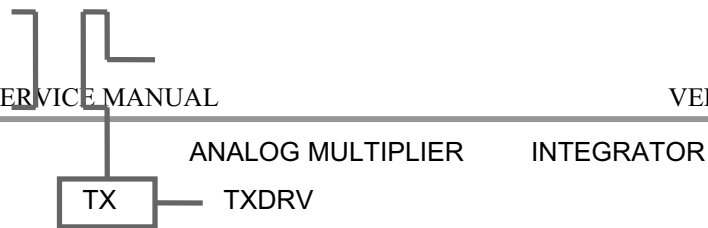
### 3) CARRY BUFFER BLOCK

Generate carrier signal (CAR1, CAR2) by using of Q1 and RXG1 for demodulation.



### 4) DOPPLER I(II) BLOCK



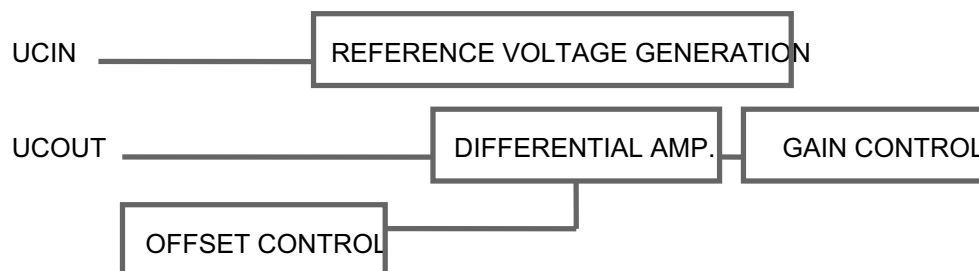


## Module Function

Module Name	Module Description
Pulse/Pre-amp	Apply electrical pulse signal to Probe and pre-amplify reflected signal.
ECHO Filter	Conduct filtering receiving ultrasound signal to remain center frequency band.
ECHO Amp	Amplify Echo Filter passed signal.
Demodulation	Demodulate from center frequency band to base frequency band.
Integration	Generate Doppler signal with by signal integrating during Pulse Repetition Frequency (PRF).
Dop Filter	Conduct filtering just the Doppler signal which is generated by movement of either fetus' cardiac wall or fetus.
Dop Amp	Amplify Doppler signal into proper signal.

## 5) UC BLOCK

- Amplify UC probe signal with transferring pressure variety into electrical signal.



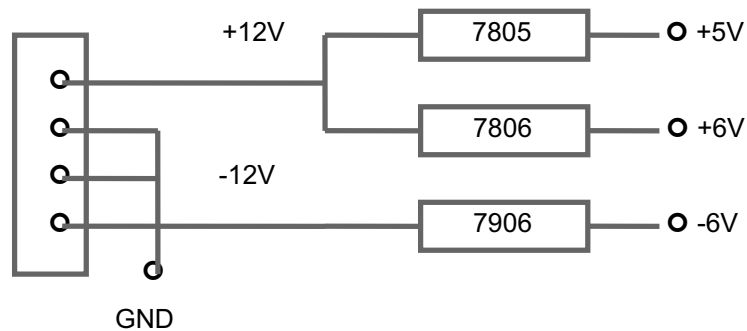
REFERENCE VOLTAGE GENERATION : Provide +6V by TTL431 for CU block.

#### Module Function

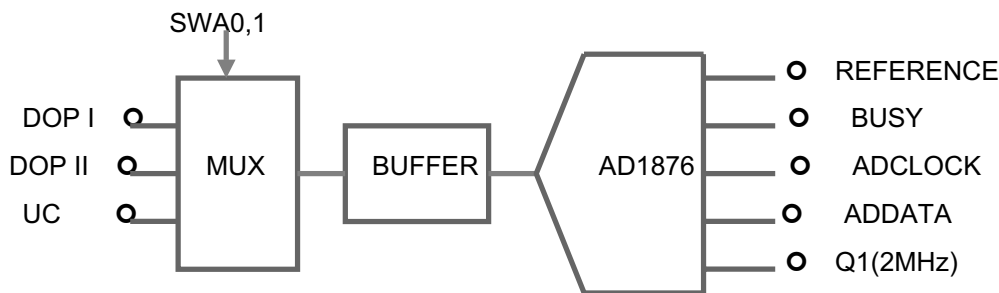
Module Name	Module Description
Pre-amp and Differential Amp	Transfer the pressure variety of Strain Gauge into electrical signal and send +UC OUTand – UCIN output signal via Differential Amp.
Reference Control	Control the reference clock into UC Probe.
Offset Control	Control the reference voltage of Strain Gauge.
UC Gain Control	Control magnitude of output signal.

## 6) POWER BLOCK

-Provide the power for analog board unit.



7) A/D CONVERTER BLOCK



AD1876 : . 16BITs

. SERIAL OUTPUT

. ±5V INPUT DYNAMIC RANGE

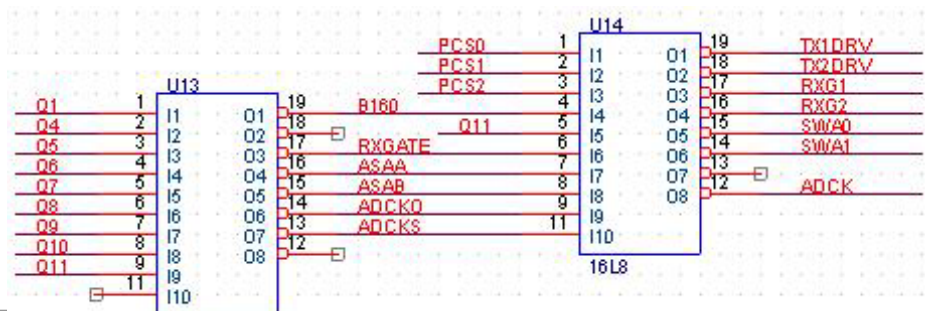
Subtract Dop I, Dop II, UC by using of MUX and each transferred signals.

Module Function

Module Name	Module Description
Analog Switch and Buffer	SWA0 and SWA1 data determines/controls the output of DOPI, DOPII and UC probes.
Analog to Digital converter	Transfer the selected Analog Signal to Digital signal.

7) TEST POINT OF ANALOG BOARD

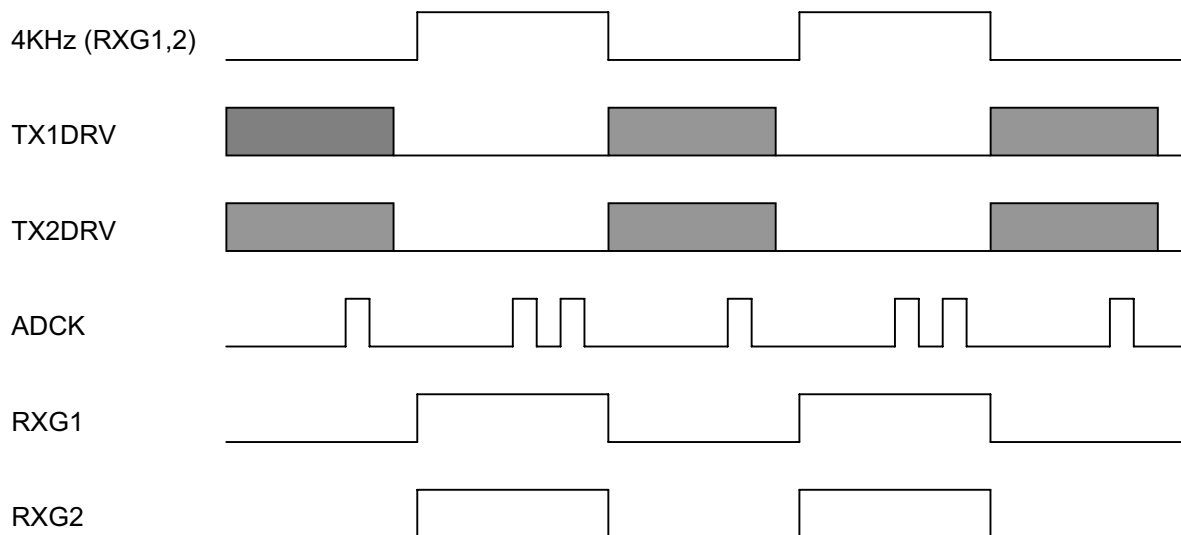
CONTROL SIGNAL GENERATION BLOCK

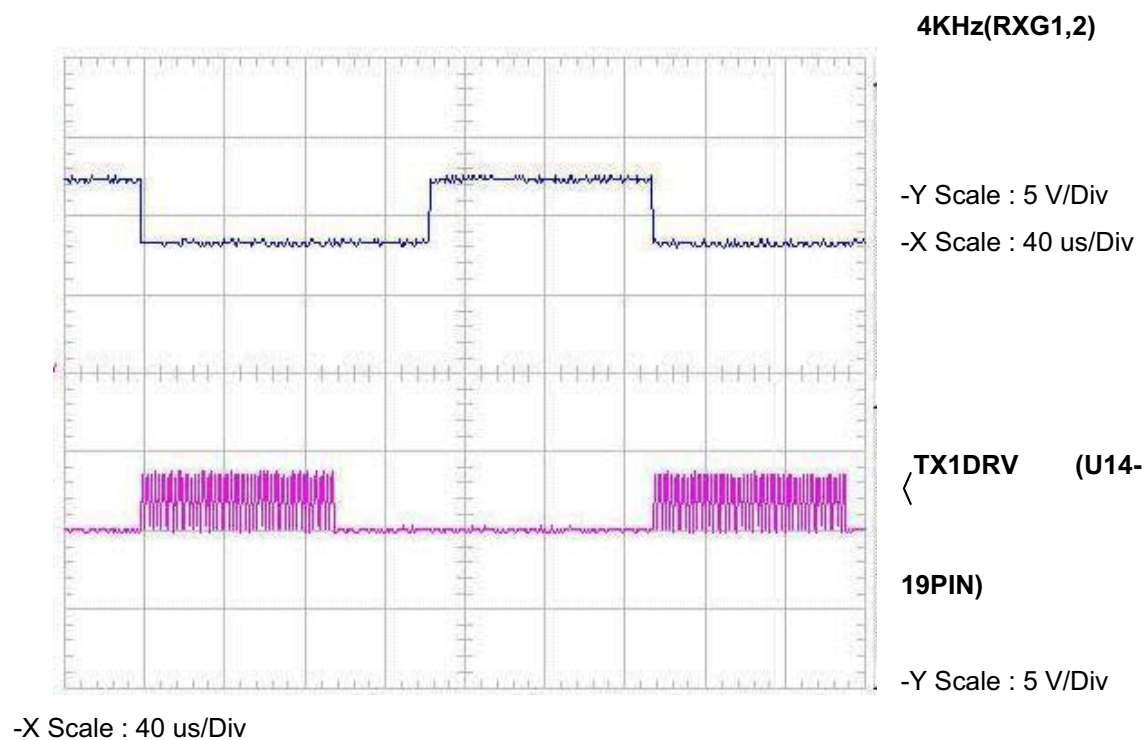




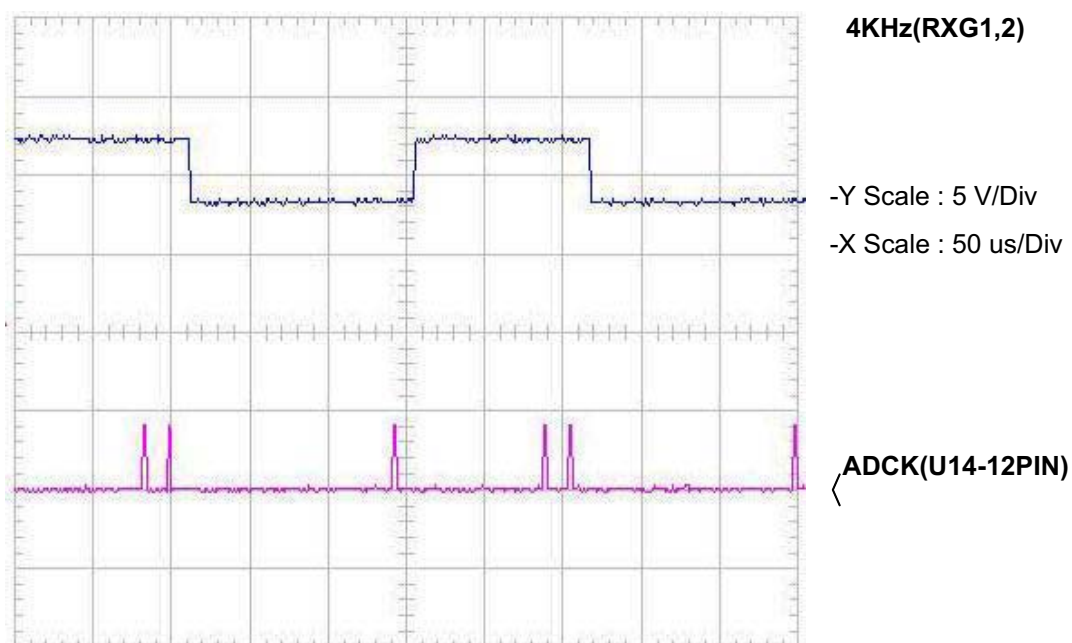
PCS2	PCS1	PCS0	PROBE usage
0	0	0	└
0	0	1	DOP I use
0	1	0	DOP II use
0	1	1	└
1	0	0	DOP I, II : Search
1	0	1	DOP I : use, DOP II : Search
1	1	0	DOP I : Search , DOP II : use
1	1	1	DOP I , II use

\ DOP I , II equipped



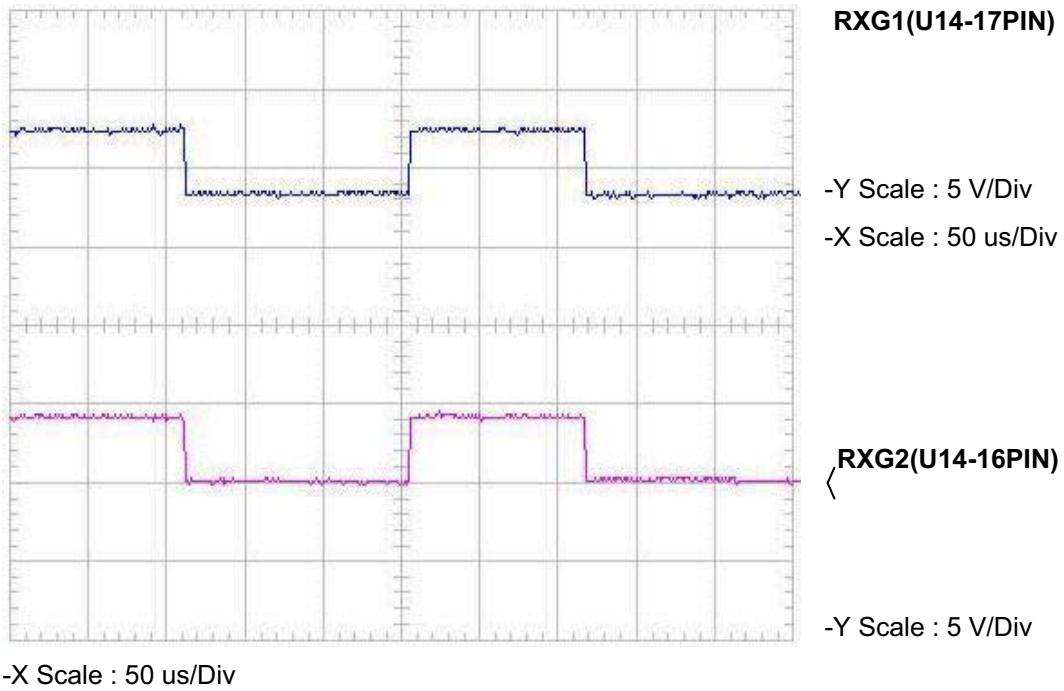


TX2DRV is same as TX1DRV.

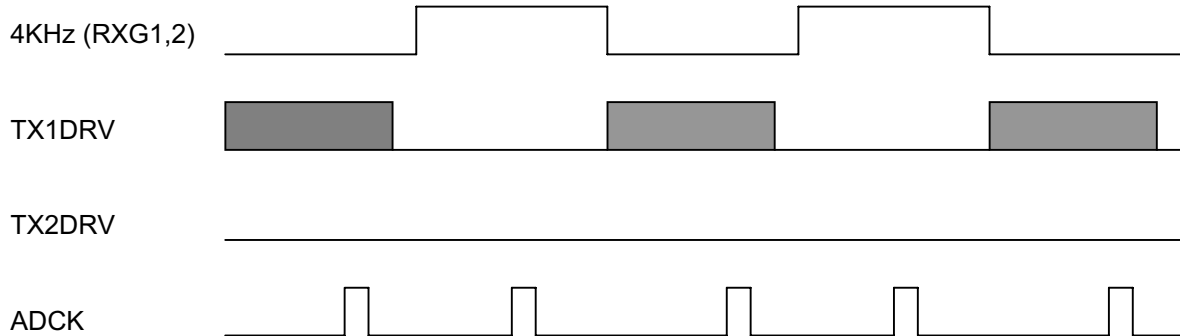


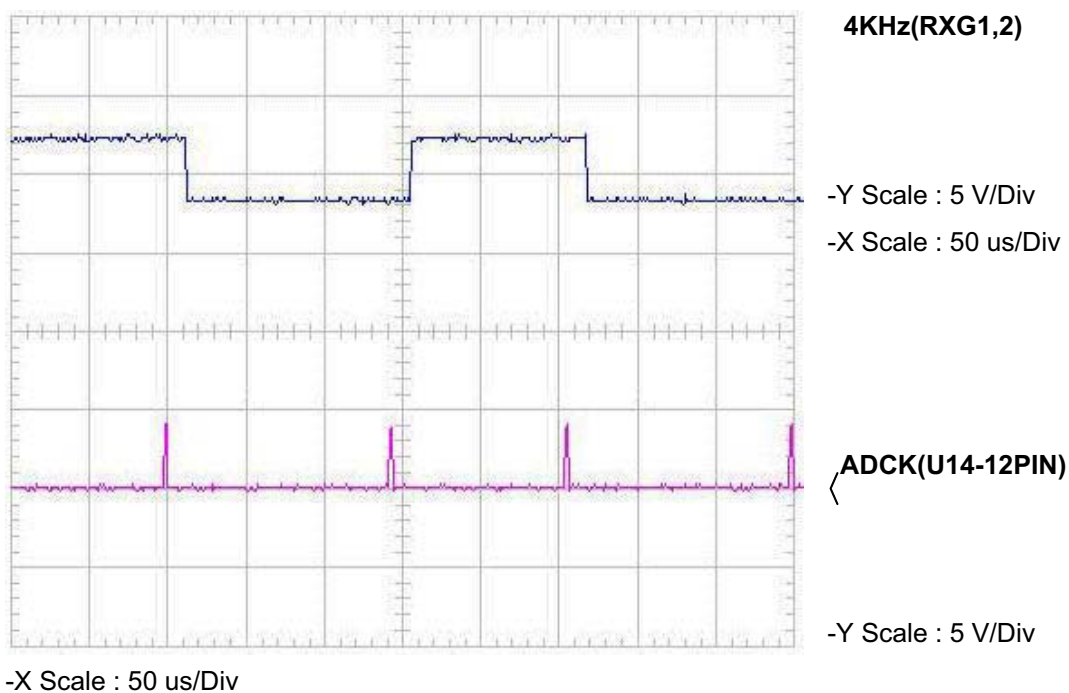
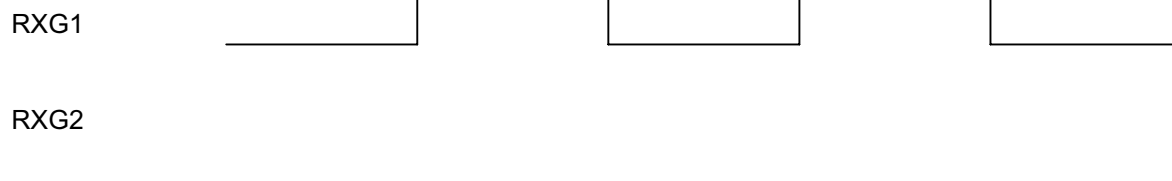
-Y Scale : 5 V/Div

-X Scale : 50 us/Div

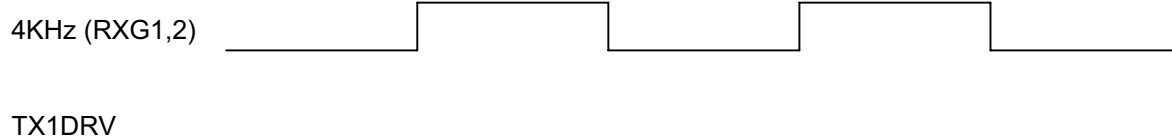


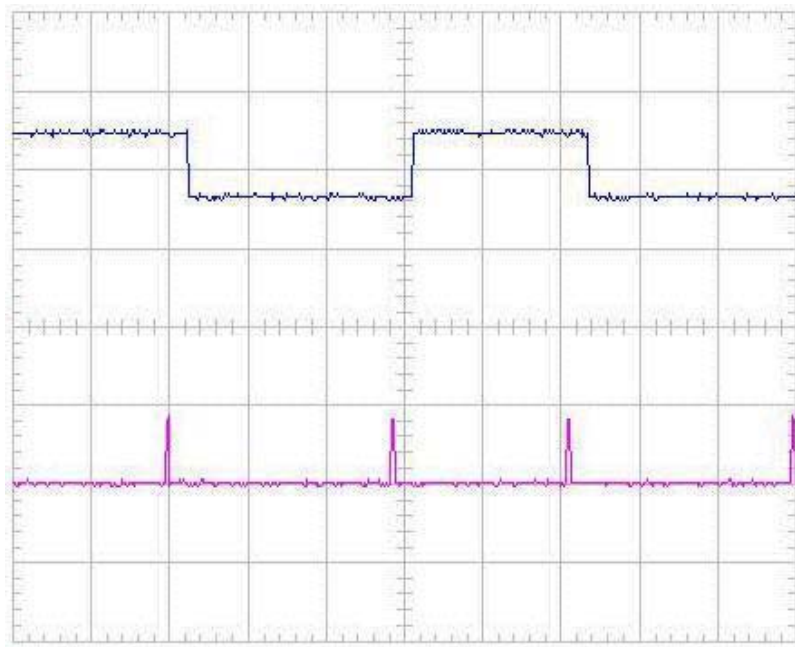
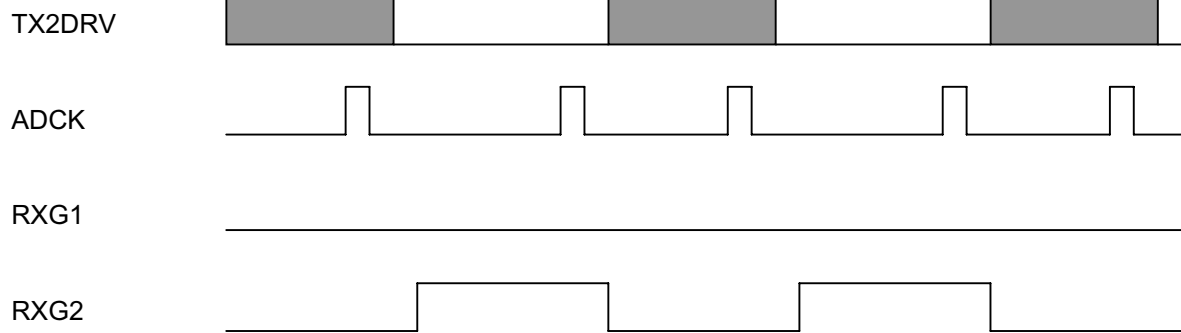
DOP I equipped, DOP II un-equipped





DOP I , II equipped





4KHz(RXG1,2)

-Y Scale : 5 V/Div

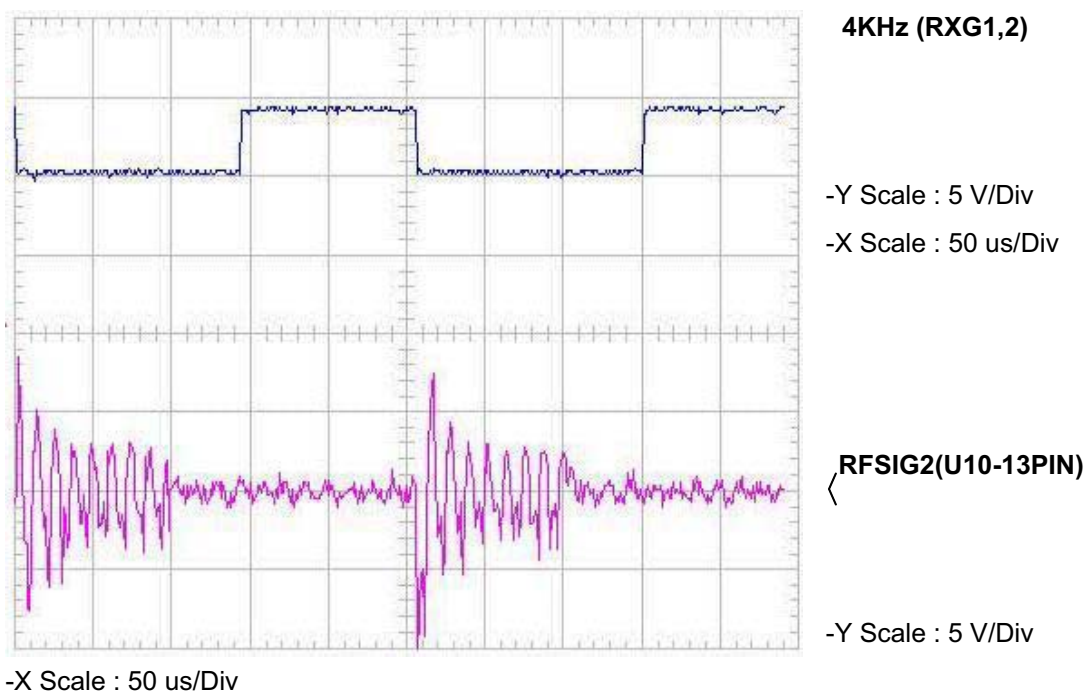
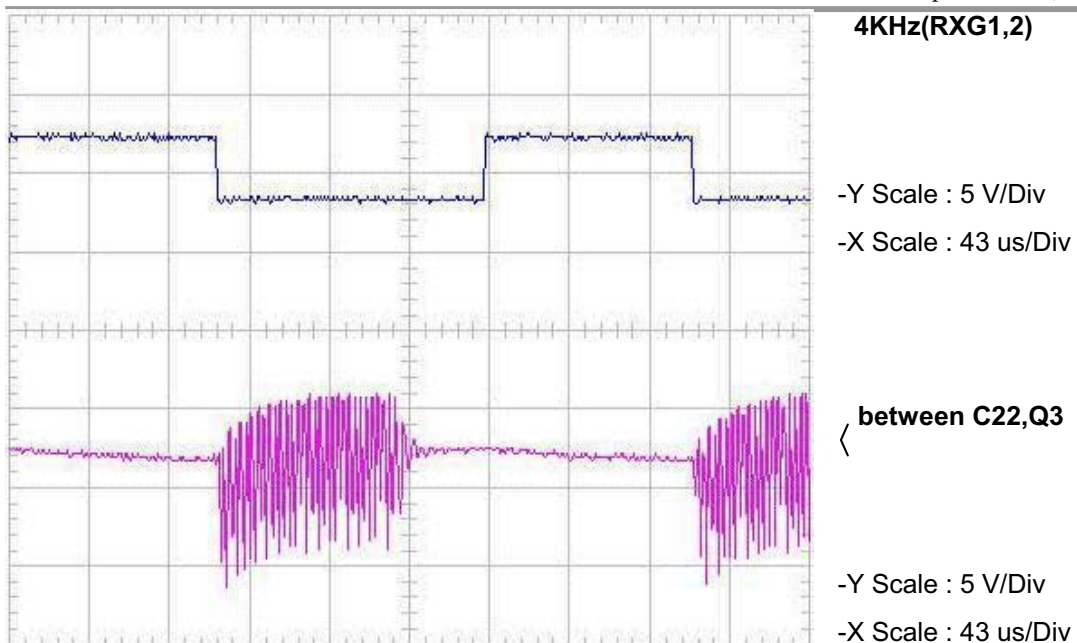
-X Scale : 50 us/Div

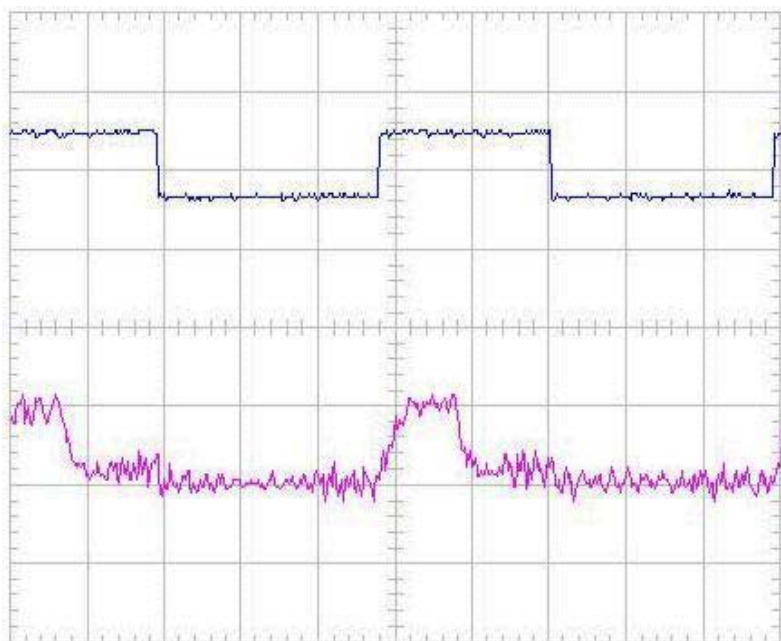
ADCK(U14-12PIN)

-Y Scale : 5 V/Div

-X Scale : 50 us/Div

DOPPLER I (II) BLOCK





**4KHz (RXG1,2)**

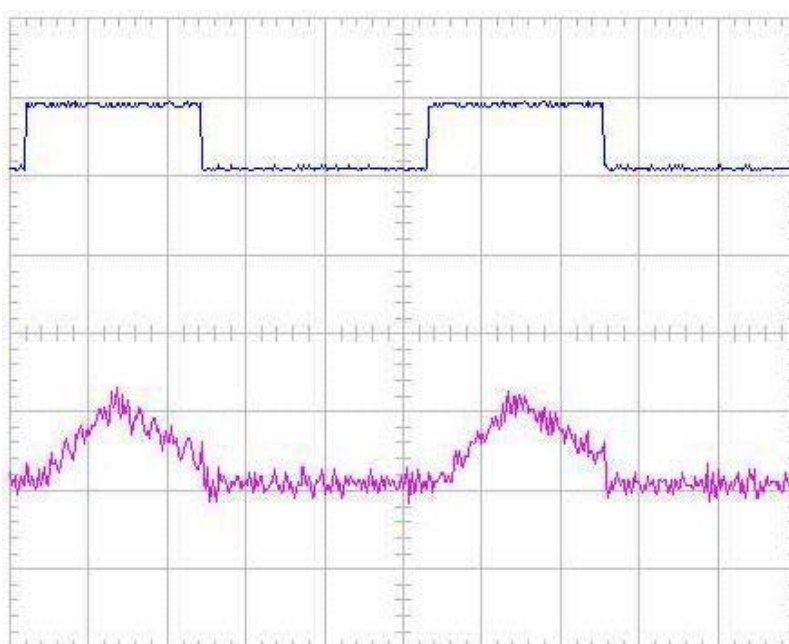
-Y Scale : 5 V/Div

-X Scale : 50 us/Div

**U20-13PIN**

-Y Scale : 500 mV/Div

-X Scale : 50 us/Div



**4KHz (RXG1,2)**

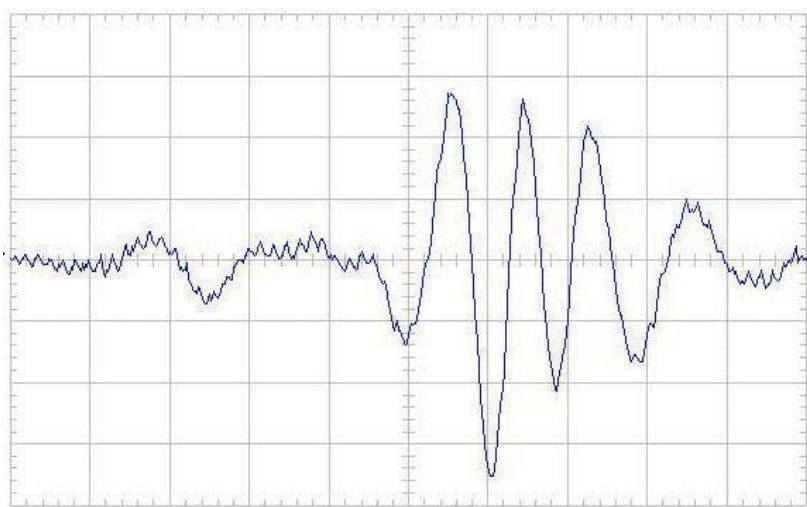
-Y Scale : 5 V/Div

-X Scale : 50 us/Div

**U7-14PIN**

-Y Scale : 300 mV/Div

-X Scale : 50 us/Div

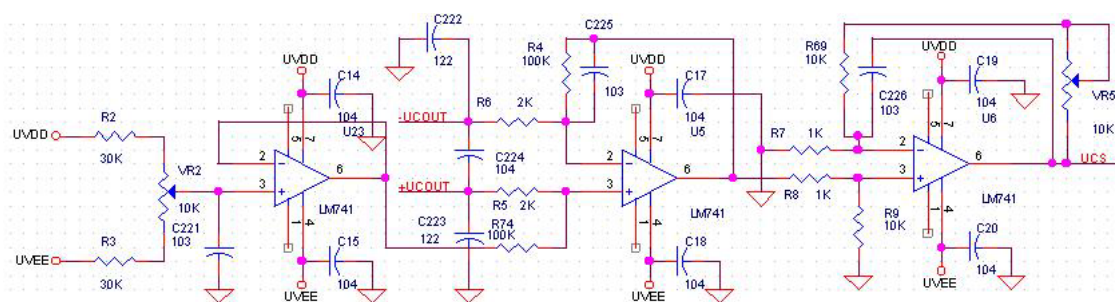


-DOP1 (U9-8PIN)

-Y Scale : 500 mV/Div

-X Scale : 5 ms/Div

## UC PROBE BLOCK



-The output of U5 6pin is changed by the detected input signal of UC probe and you will



watch the change.

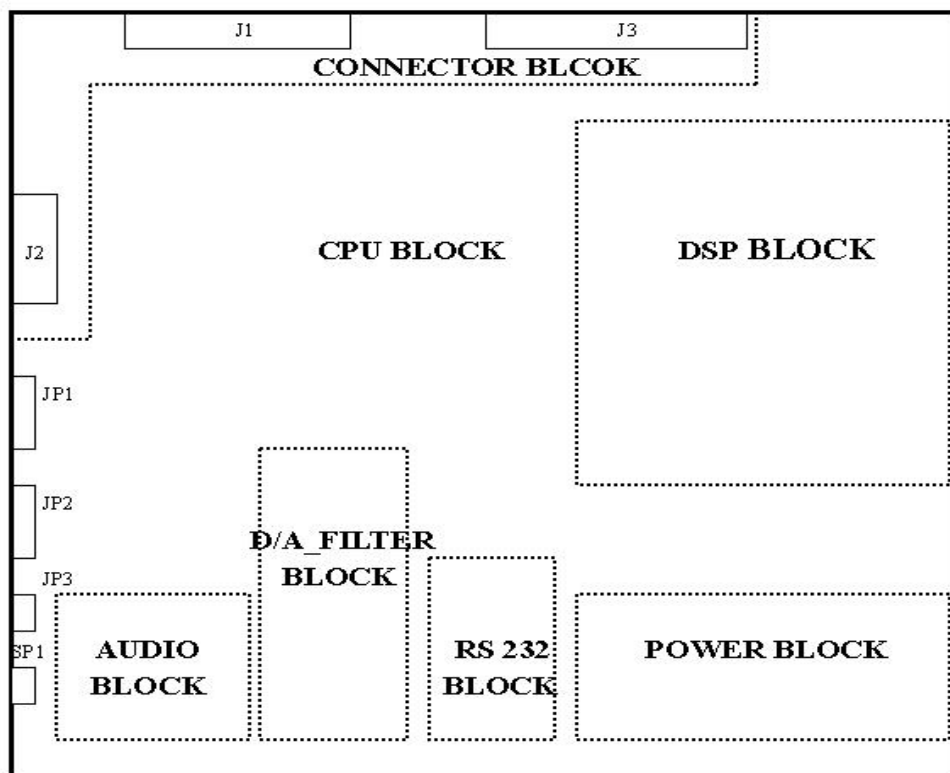
## 9) SCHEMATIC DIAGRAM

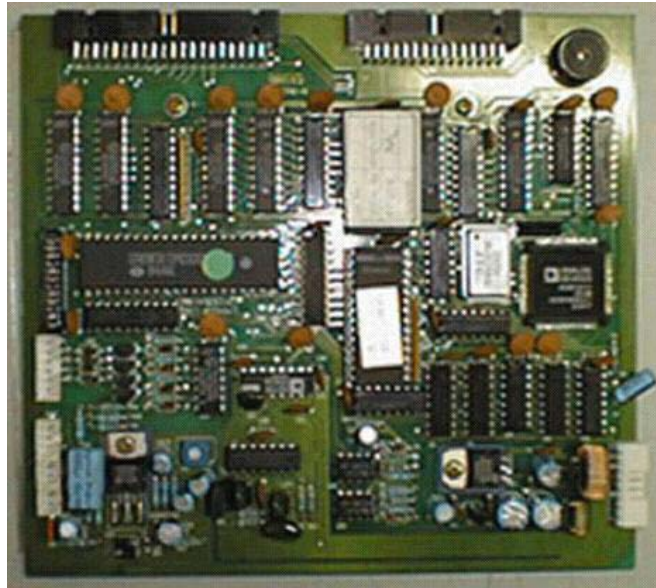
- A. See appendix

### 3.2 DIGITAL BOARD

Digital board calculates FHR(Fetal Heart Rate) and UC(Uterine Contraction). It also controls Display board Unit, Printer Unit and Analog Board Unit and generates output Data.

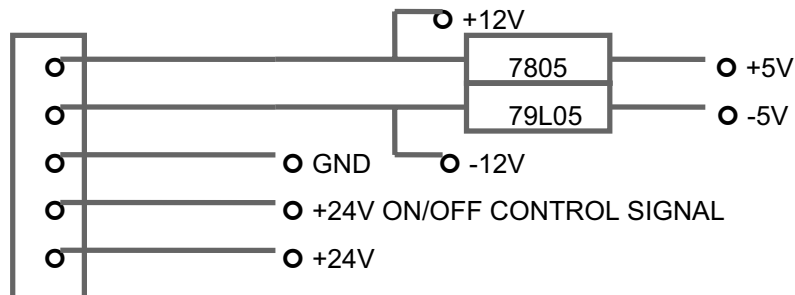
CONFIGURATION





## 1) POWER BLOCK

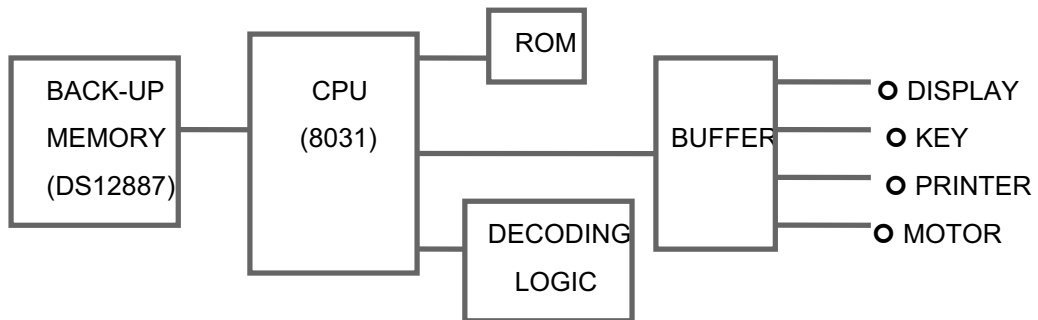
- Supply necessary power for Digital Board Unit.



+24V is controlled by +24V ON/OFF control signal.

## 2) CPU BLOCK

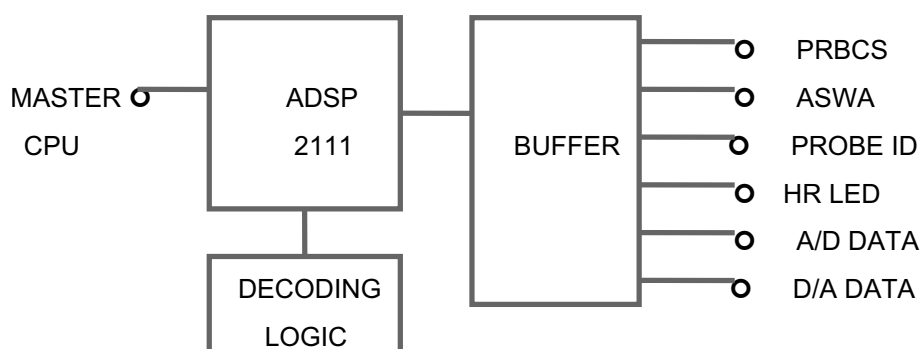
- DSP controlled and communicates.
- Control printer and print out the FHR I, FHR II and UC data.
- Display the FHR1, FHRII and UC Data on Display Board Unit.
- Executes designated function in accordance with Display Board Unit's Key input.



CPU block is consist of master CPU, back-up memory, ROM, decoding logic and I/O buffer.

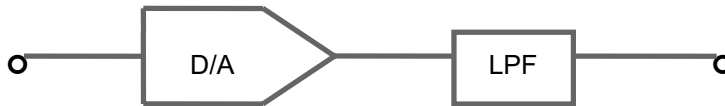
### 3) DSP BLOCK

- Calculates FHR I and II and transmits HOST CPU BLOCK.
- Calculates UC and transmits HOST CPU BLOCK.
- Send Fetal Heart Beat Sound to Audio Drive Block.
- Send output with sensing the signal quality.



#### 4) D/A and FILTER BLOCK

- Transmits Doppler audio digital signal to Analog signal and send that to audio block.



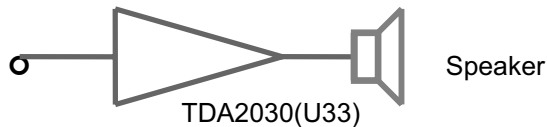
AD766(U32)

D/A : 16 bits digital to analog converter

LPF : It removed the high frequency noise.

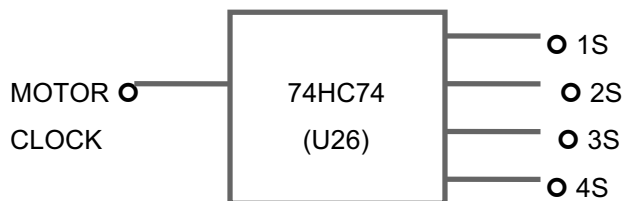
#### 5) AUDIO BLOCK

- Amplify the fetal heart beat sound signal which comes from D/A and Filter block and send output through speaker.

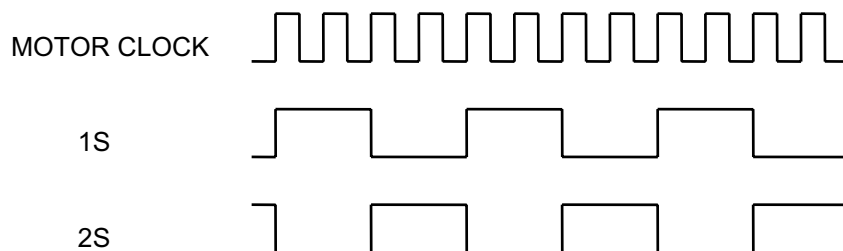


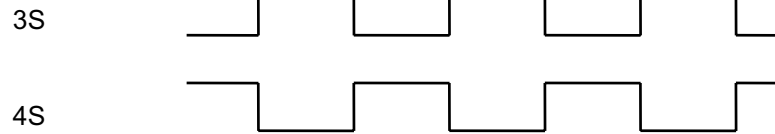
#### 6) MOTOR BLOCK

Transmitted motor clock from CPU block and send 4 pulses to control stepping motor.



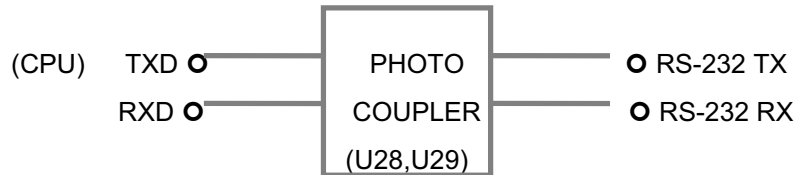
-Timing diagram





## 7) RS-232 BLOCK

- Executes serial communication with external computer.



## 8) CONNECTOR BLOCK

- Connect with TPH module, Display Board and Connector Board.(J1,J2,J3)

Pin definition of display board connector

Pin #	Pin Name	Description	Pin #	Pin Name	Description
1	VCC	+5V	2	GND	Ground
3	REC_LAMP	Record ON lamp	4	SEG_EN	7-seg. Decoder enable
5	A	7-seg. A	6	ALM_LAMP	Alarm lamp
7	B	7-seg. B	8	HR1_RED	HR1 Red lamp
9	C	7-seg. C	10	HR1_GREEN	HR1 Green lamp
11	D	7-seg. D	12	HR2_RED	HR2 Red lamp
13	E	7-seg. E	14	HR2_GREEN	HR1 Green lamp
15	F	7-seg. F	16	VOL_UP1	Volume 1 up key
17	G	7-seg. G	18	VOL_DN1	Volume 1 down key
19	DOT	7-seg. DOT	20	VOL_UP2	Volume 2 up key
21	S_CON0	7-seg. 0 Enable	22	VOL_DN2	Volume 3 down key
23	S_CON1	7-seg. 1 Enable	24	UC_ZERO	UC reference key

25	S_CON2	7-seg. 2 Enable	26	ALARM	Alarm key
27	UC0	UC LED 0	28	CALIB	Calibration key
29	UC1	UC LED 1	30	RECORD	Record key
31	UC2	UC LED 2	32	SOUND2	Dop 2 selection lamp
33	UC3	UC LED 3	34	SOUND1	Dop 1 selection lamp
35	UC4	UC LED 4	36	UC9	UC LED 9
37	UC5	UC LED 5	38	UC8	UC LED 8
39	UC6	UC LED 6	40	UC7	UC LED 7

< Pin definition of door sensor connector

Pin #	Pin Name	Description
1	SW1	High Level (Pull-up)
2	SW2	Ground

> Pin definition of motor connector

Pin #	Pin Name	Description
1	1S	Phase 1 for stepping motor
2	2S	Phase 2 for stepping motor
3	3S	Phase 3 for stepping motor
4	4S	Phase 4 for stepping motor
5	+24V	+24V
6	+24V	+24V

## | Pin definition of paper sensor connector

Pin #	Pin Name	Description
1	PR1	VCC(+5V)
2	PR2	Ground
3	PR3	VCC(+5V)
4	PR4	Paper Sensing Signal

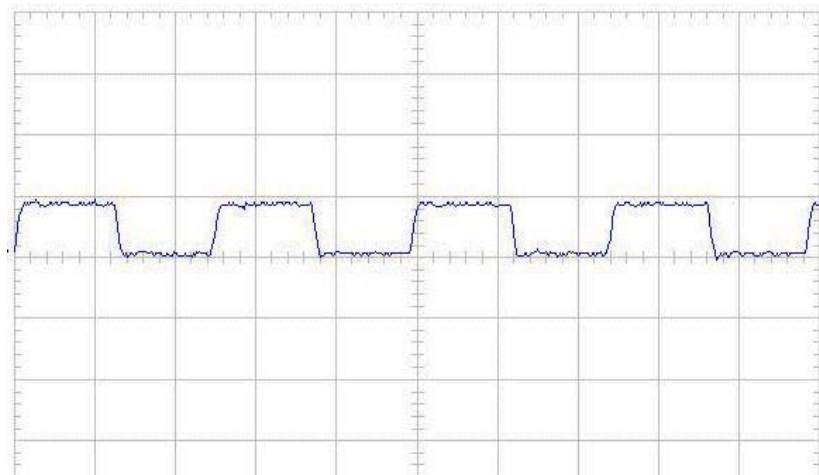
## || Pin definition of printer(TPH) connector

Pin #	Pin Name	Description	Pin #	Pin Name	Description
1	+24V	+24V	2	+24V	+24V
3	GND	Ground	4	+24V	+24V
5	GND	Ground	6	GND	Ground
7	TOUT_DATA	TPH Data	8	TOUT_STRB 4	TPH Strobe 4
9	TOUT_CLK	TPH Clock	10	TOUT_STRB 3	TPH Strobe 3
11	GND	Ground	12	GND	Ground
13	VCC	+5V	14	TOUT_STRB 2	TPH Strobe 2
15	BEO	Enable(+5V)	16	TOUT_STRB 1	TPH Strobe 1
17	TOUT_LE	TPH Latch Enable	18	-	-
19	-	-	20	-	-
21	GND	Ground	22	GND	Ground
23	GND	Ground	24	+24V	+24V
25	+24V	+24V	26	+24V	+24V

## / Pin definition of connector board connector

Pin #	Pin Name	Description	Pin #	Pin Name	Description
1	RGND	RS232 Ground	2	RS232TX	RS232 Transmit
3	DTR+12	RS232 +12V	4	RS232RX	RS232 Receive
5	UID	UC Identity	6	RTS_12	RS232 -12V
7	PID2	Doppler 2 Identity	8	MARK	Mark Switch
9	PID1	Doppler 1 Identity	10	GND	Ground
11	ADOUT	A/D out data	12	GND	Ground
13	ADCLK	A/D out clock	14	GND	Ground
15	BUSY	A/D state signal	16	GND	Ground
17	ASWA1	Analog S/W addr. 1	18	GND	Ground
19	ASWA0	Analog S/W addr. 0	20	GND	Ground
21	PRBCS2	Probe chip select. 2	22	GND	Ground
23	PRBCS1	Probe chip select. 1	24	GND	Ground
25	PRBCS0	Probe chip select. 0	26	GND	Ground
27	8M	8MHz clock	28	GND	Ground
29	-	-	30	GND	Ground

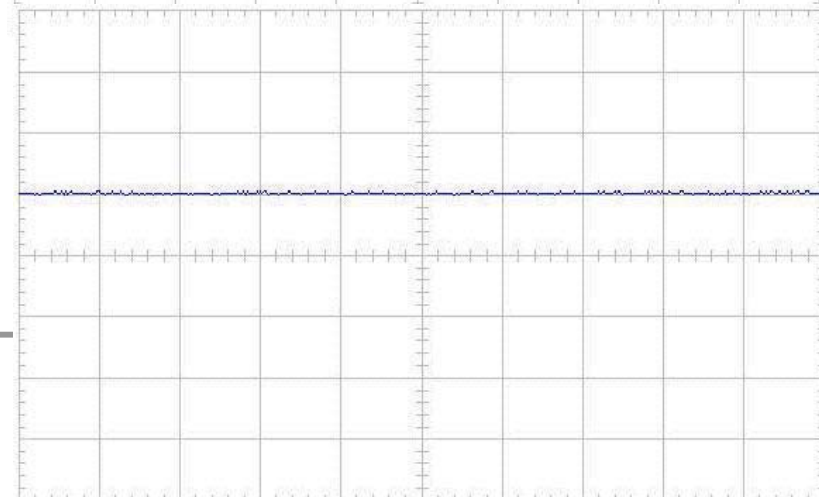
## 9) TEST POINT OF DIGITAL BOARD



**-8M (J3-27PIN)**

-Y Scale : 5 V/Div

-X Scale : 5 ms/Div



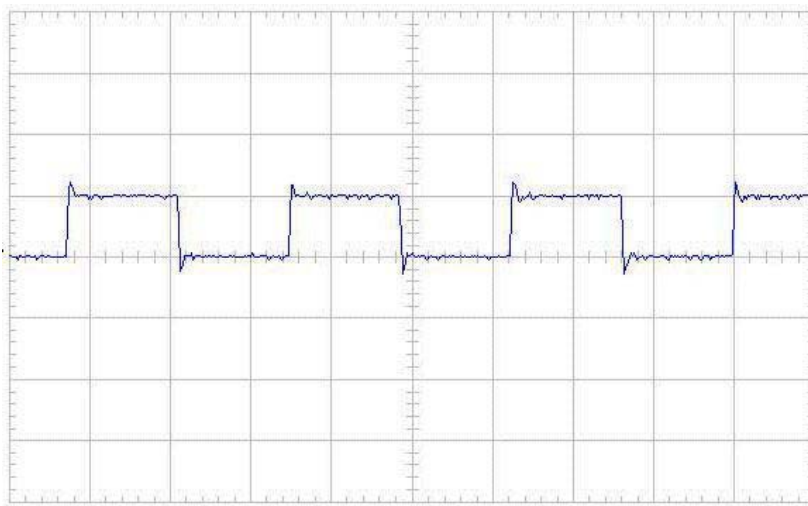
**-PRBCS0 (J3-25PIN)**



-Y Scale : 5 V/Div

-X Scale : 5 ms/Div

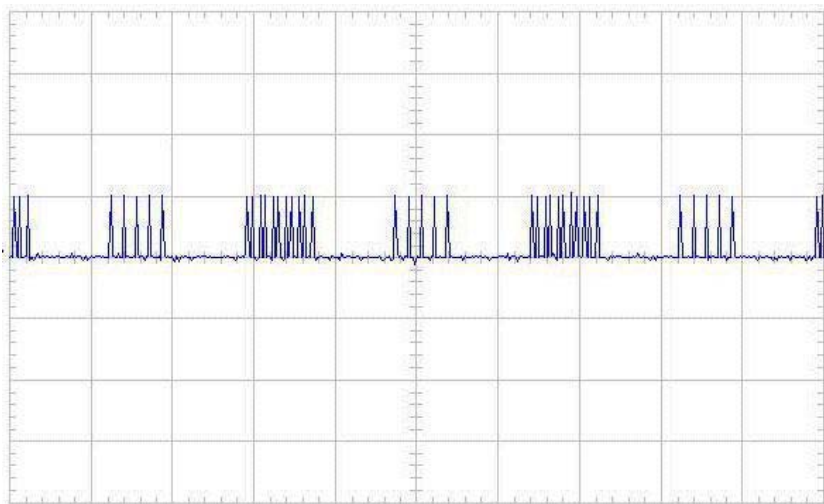
PRBCS1 and PRBCS2 are same as PRBCS0.



**-ADCLK (J3-13PIN)**

-Y Scale : 5 V/Div

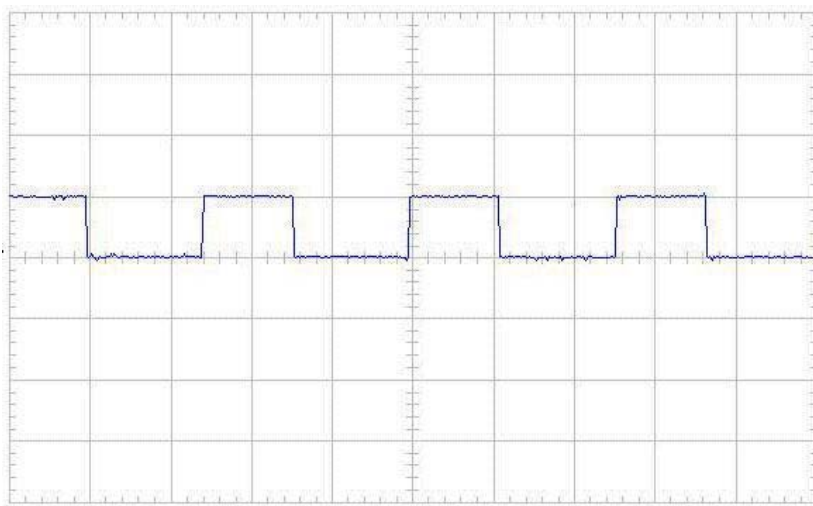
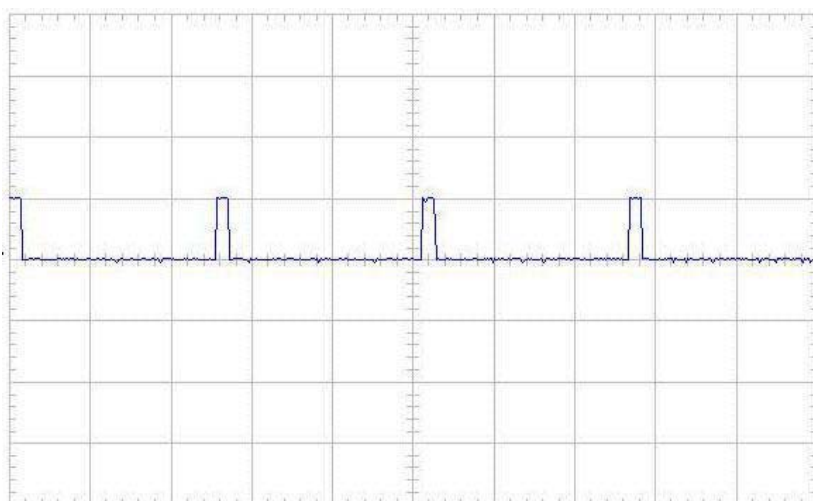
-X Scale : 20 ms/Div



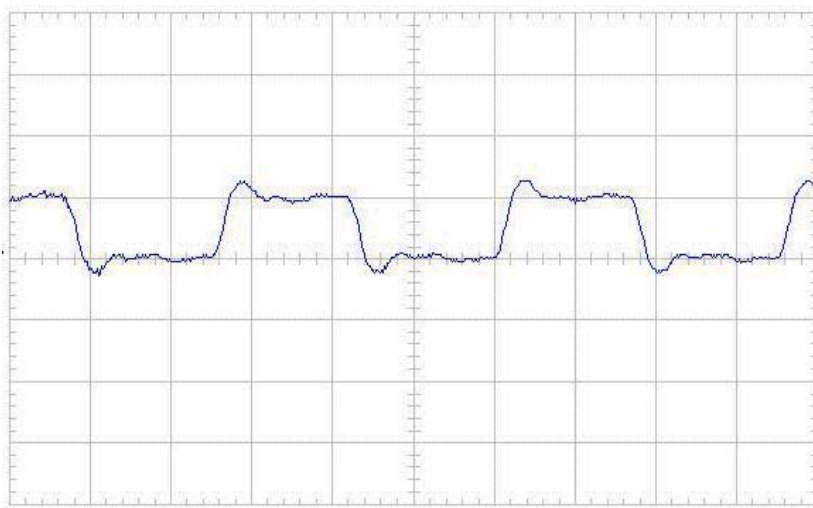
**-BUSY (J3-15PIN)**

-Y Scale : 5 V/Div

-X Scale : 1 s/Div

**-ASWA0 (J3-19PIN)****-Y Scale : 5 V/Div****-X Scale : 100 us/Div****-ASWA1 (J3-17PIN)****-Y Scale : 5 V/Div****-X Scale : 100 us/Div**

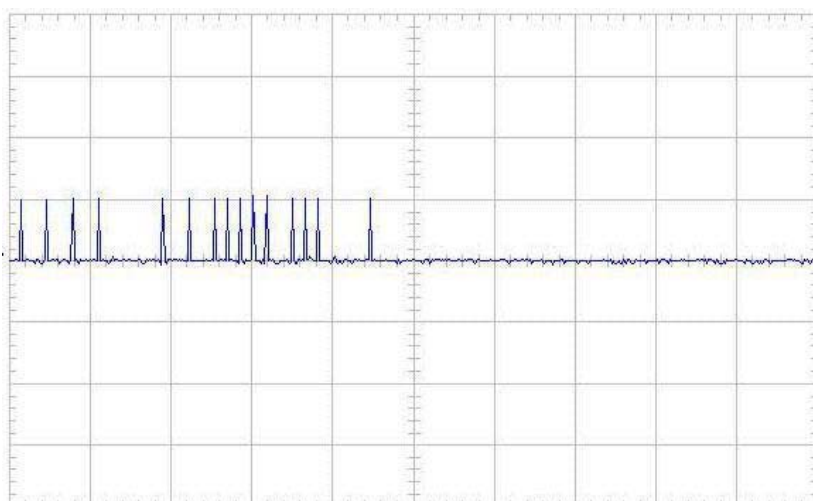
---



**-16M-2 (U1-19PIN)**

-Y Scale : 5 V/Div

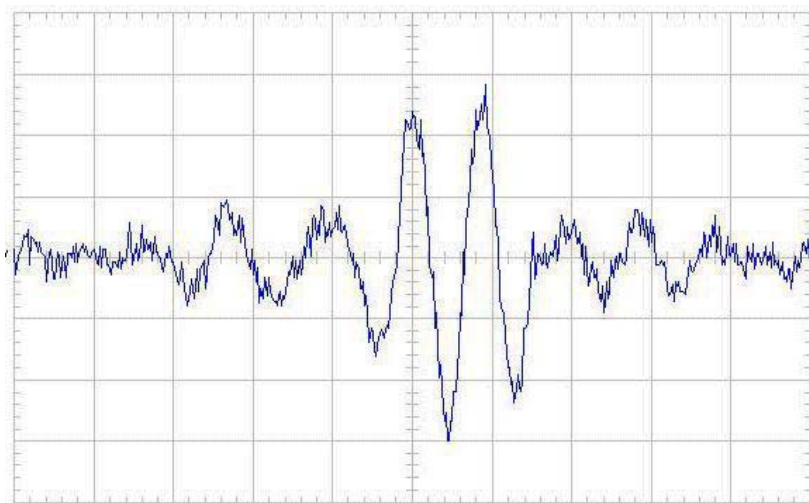
-X Scale : 2 ms/Div



**-BFR DATA(U32-7PIN)**

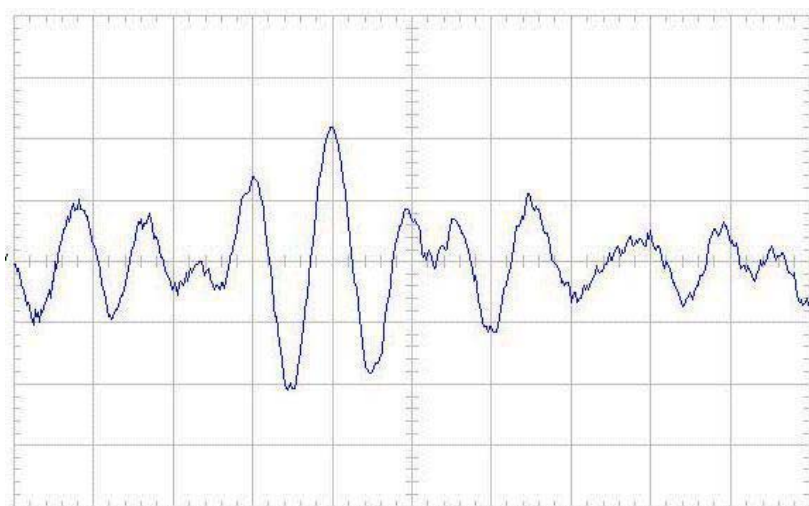
-Y Scale : 5 V/Div

-X Scale : 200 ms/Div

**- U32-9PIN (AD766)**

-Y Scale : 200 mV/Div

-X Scale : 5 ms/Div

**-AUDIO (SP1-1PIN)**

-Y Scale : 500 mV/Div

-X Scale : 5 ms/Div

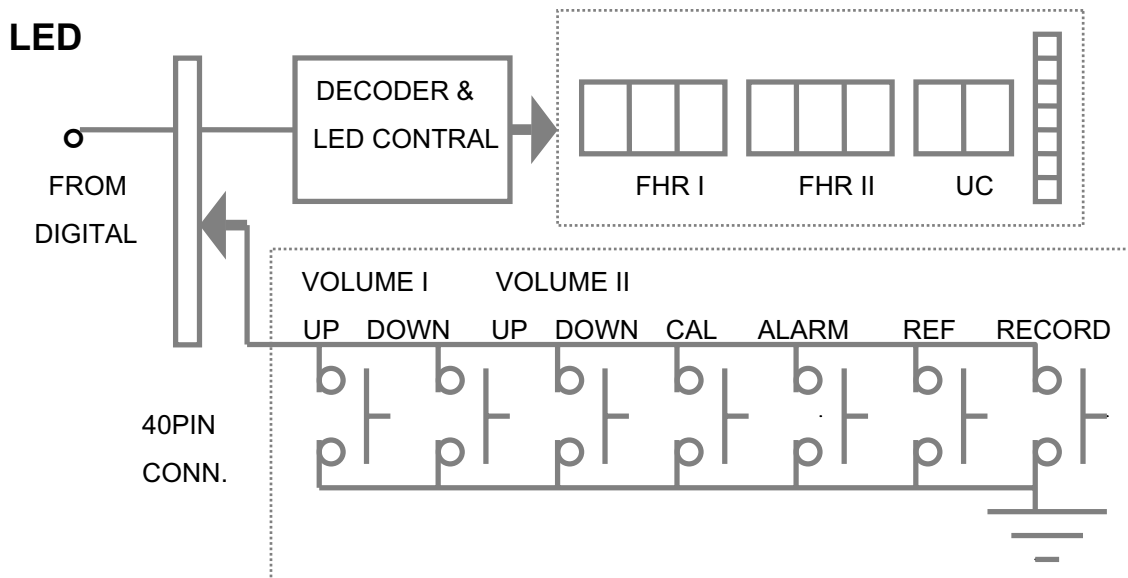
## 10) SCHEMATIC DIAGRAM

- A. See appendix

### 3.3 DISPLAY BOARD

It is consist of two 3-Digit 7-Segments, one 2-Digit 7-Segment, 10 dot LEDs, two Dual Color LEDs, two One-Color-LEDs, eight Key Buttons and Decoder(U1).

U3,U4 displays FHR I and II values, U5 displays UC value in figure, U2 displays in bar type. 8031 CPU in the digital board sends and controls the data of U2, U3, U4 and U5. 8031 CPU in the digital board sense the input data from eight key button. Two Signal Quality Indicator LED(D3,D4) is controlled by DSP of Digital Board. Two Selected LED(D1,D2) is controlled by 8031 CPU of Digital Board.



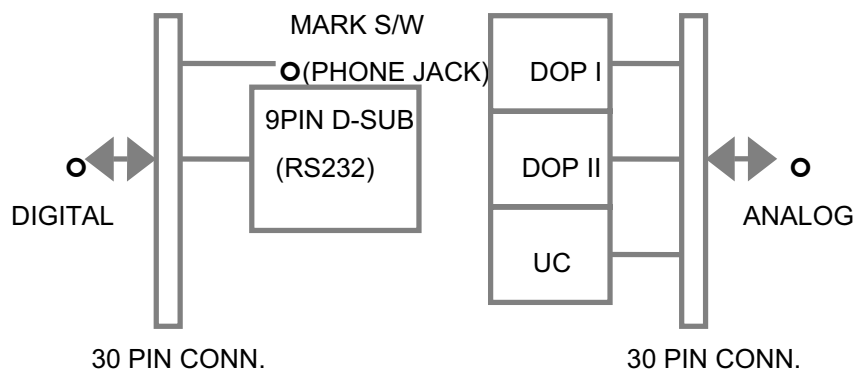
- Pin definition : See connector block of Digital board

## -SCHEMATIC DIAGRAM

- A. See Appendix

### 3.4 CONNECTOR BOARD

It is consist of two DOP Probe Connectors, one UC Probe Connector, one RS-232 9-pin Connector, one Remote Event Marker Connector, one Analog Board Unit Connector, one Digital Board Unit and connected in each unit with each other.



- Probe 5 Pin Connector Pin Definition

DOP I ( II )			UC		
Pin #	Pin Name	Description	Pin #	Pin Name	Description
1	APID1 (2)	Dop Identity	1	+UCOUT	Plus UC Output
2	DOP 1 (2) G	Dop Ground	2	AUCID	Analog UC Identity
3	DOP 1 (2) S	Dop Signal	3	+UCIN	Plus UC Input
4	GND	Ground	4	-UCIN	Minus UC Input
5	GND	Ground	5	-UCOUT	Minus UC Output

## -SCHEMATIC DIAGRAM

- A. See Appendix

## 3.5 POWER BOARD

### - Electrical SPECIFICATION

#### i) Input Specification

- 1) Input Range : AC 110V - 240V free voltage
- 2) Frequency : 50Hz / 60 Hz
- 3) Input current
  - 1A max. at AC 100V / 60Hz
  - 0.5 max at AC 220V / 60Hz

#### ii) Output Specification

J1 (for analog board unit)

NO	VOLTAGE	CURRENT		NIPPLE NOISE	TOLERANCE
		MIN	MAX		
1	+12V	0.5A	1.5A	1%	± 5%
2	GND	-	-	-	-
3	GND	-	-	-	-
4	-12V	0.05A	0.2A	1%	± 5%

J2 (for digital board unit)

NO	VOLTAGE	CURRENT		NIPPLE NOISE	TOLERANCE
		MIN	MAX		
5	+12V	0.5A	1.5A	1%	± 5%

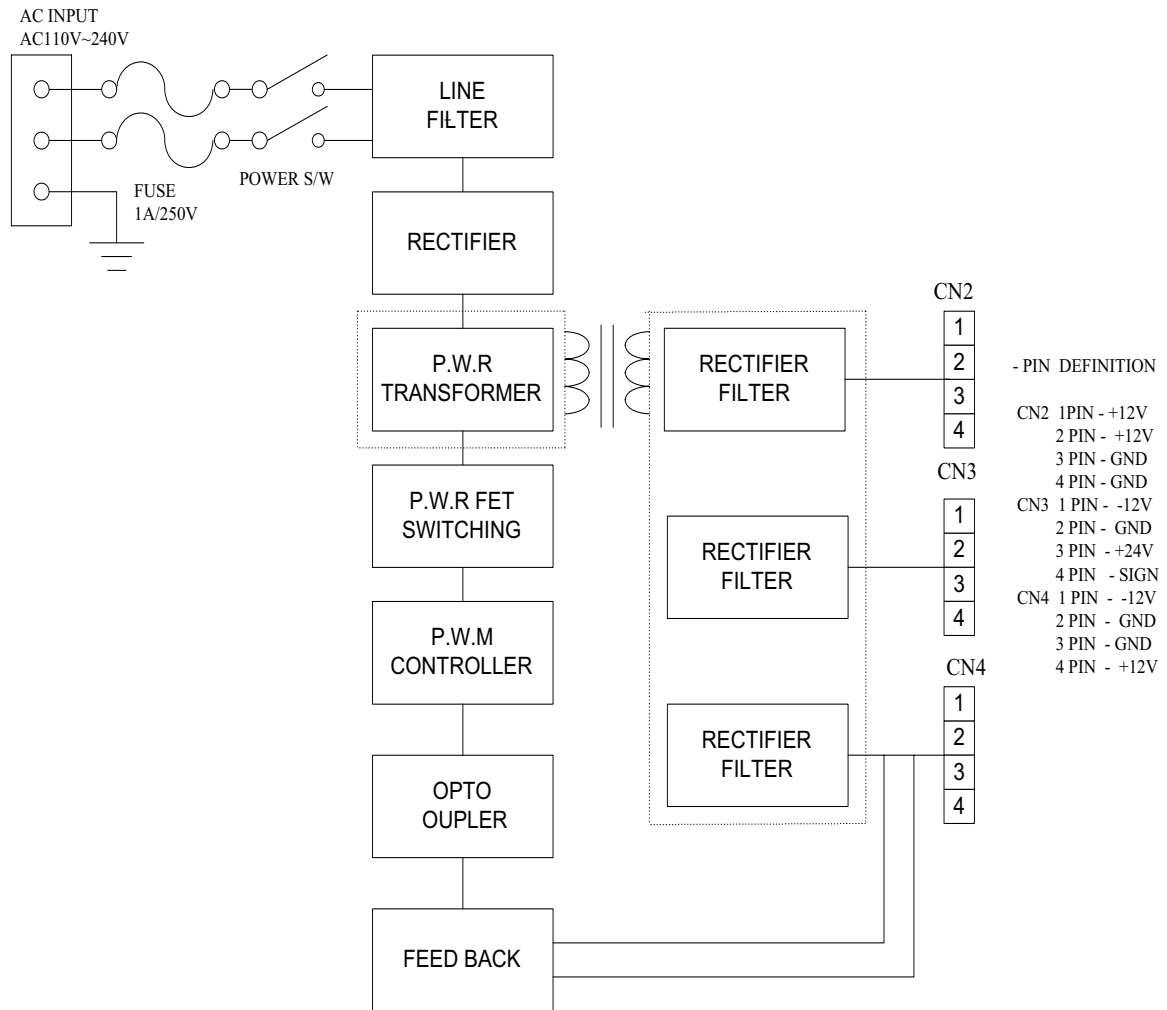
6	+12V	0.5A	1.5A	1%	±5%
7	GND	-	-	-	-
8	GND	-	-	-	-

J3 (for digital board unit)

NO	VOLTAGE	CURRENT		NIPPLE NOISE	TOLERANCE
		MIN	MAX		
9	-12V	0.05A	0.2A	1%	±5%
10	GND	-	-	-	-
11	+24V	0.05A	0.3A	1%	±5%
12	+24VS	+24V OPTPUT CONTROL SIGNAL			

## - BLOCK DIAGRAM





## -SCHEMATIC DIAGRAM

- A. See Appendix

## 4. PROBE UNIT

Ultrasound transducer sends and receives the signal. There are seven elements for wider coverage.

Uterine contraction is measured by using of Strain gauge and offset can be adjustable with variable resistor in the sensor.

## 1) Doppler Probe

### - Function

Transmit electrical pulse signal into ultrasound signal. Transmit reflected ultrasound signal from the fetal heart wall into electrical signal. Seven ultrasound transducer elements support wider detectable region..

Doppler probe is engaged by cable and connector with connector board unit.

### Pin Description

Pin#	Pin Name	Description
1	PID	Dop Probe Identification
2	DOPG	TRD Ground
3	DOPS	TRD Signal
4	GND	System Ground

## 2) UC Probe

### - Function

The pressure of strain gauge is transferred into electrical resistance. Adjust with offset VR in order to 0V output in case of zero load.

### Pin Description

Pin#	Pin Name	Description
1	+UCOUT	+ UC Output
2	-UCOUT	- UC Output
3	+UCIN	+ UC Input
4	-UCIN	- UC Input
5	UPID	UC Probe Identification

## 5. PRINTER UNIT



Printer Unit has components such as Step Motor, TPH, Paper Sensor (Photo Reflector) and Door Sensor (Micro Switch) on its main case.

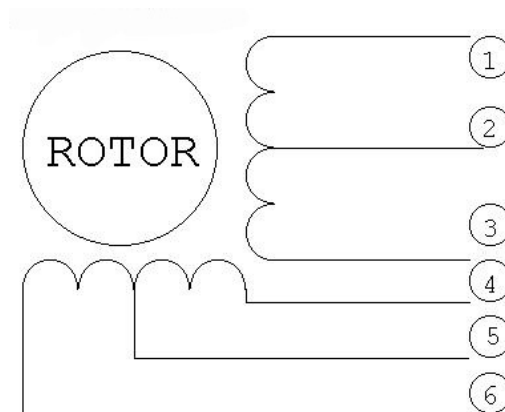
TPH Connect Cable, Paper Sensor Cable, Door Sensor Cable and Step Motor Cable are connected with J2,JP1,JP2,JP3 in Digital Board Unit respectively.

## 1) Step Motor

4 phase stepping motor. This motor rotates  $x^\circ$  per one step. (Model type : NPM PF42-48B1)

—Rotation Direction—

CCW(counter-clockwise) 				
No	1	2	3	4
Black	ON	OFF	OFF	ON
Brown	OFF	ON	ON	OFF
Orange	ON	ON	OFF	OFF
Yellow	OFF	OFF	ON	ON
No	4	3	2	1
 CW(Clockwise)				



- |                        |                          |
|------------------------|--------------------------|
| 1. Black : first phase | 2. Red : com(A)          |
| 3. Brown : third phase | 4. Orange : second phase |
| 5. Red : com(B)        | 6. Yellow : four phase   |

## 2) TPH (Thermal Print Head)

THERMAL PRINT HEAD, TPH, is the component which marks the image information on the thermal paper by using of CONTACT IMAGE SENSOR, CIS. Model type : TPH 8T26C

SAMSUNG)

## - Electrical Characteristic

Input voltage : 24V

Mean input voltage : 0.46 W/dot

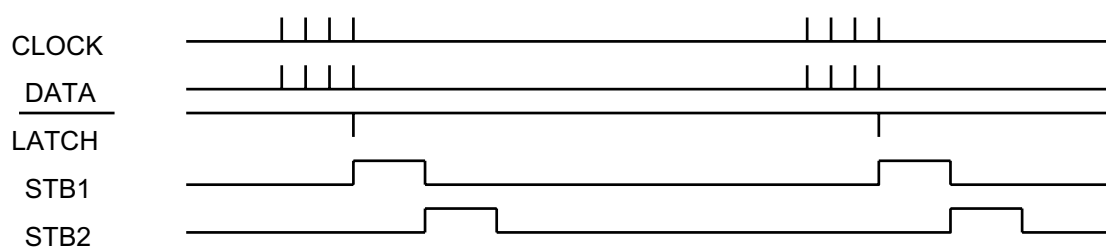
Pulse width : 0.76 ms (typ.)

Pulse cycle : 0.5 ms

## Pin Connection

Connector A		Connector B	
No	Name	No	Name
1	DATA IN	1	GND
2	LATCH	2	GND
3	CLK	3	GND
4	STB1	4	GND
5	STB2	5	GND
6	STB3	6	GND
7	STB4	7	VH
8	DATA OUT	8	VH
9	VDD	9	VH
10	TM	10	VH
11	TM	11	VH
		12	VH

## Timing diagram



SRB3

STB4

## 6.SETTING(SET-UP MODE)

### 1) Initial SET-UP

The default setup of date & time, Printer Record Speed, record CONTRAST, auto-recording time, upper and lower limit of FHR ALARM, OFFSET Mode status and ALARM status are set as following. Customer have to modify following setup status as they need.

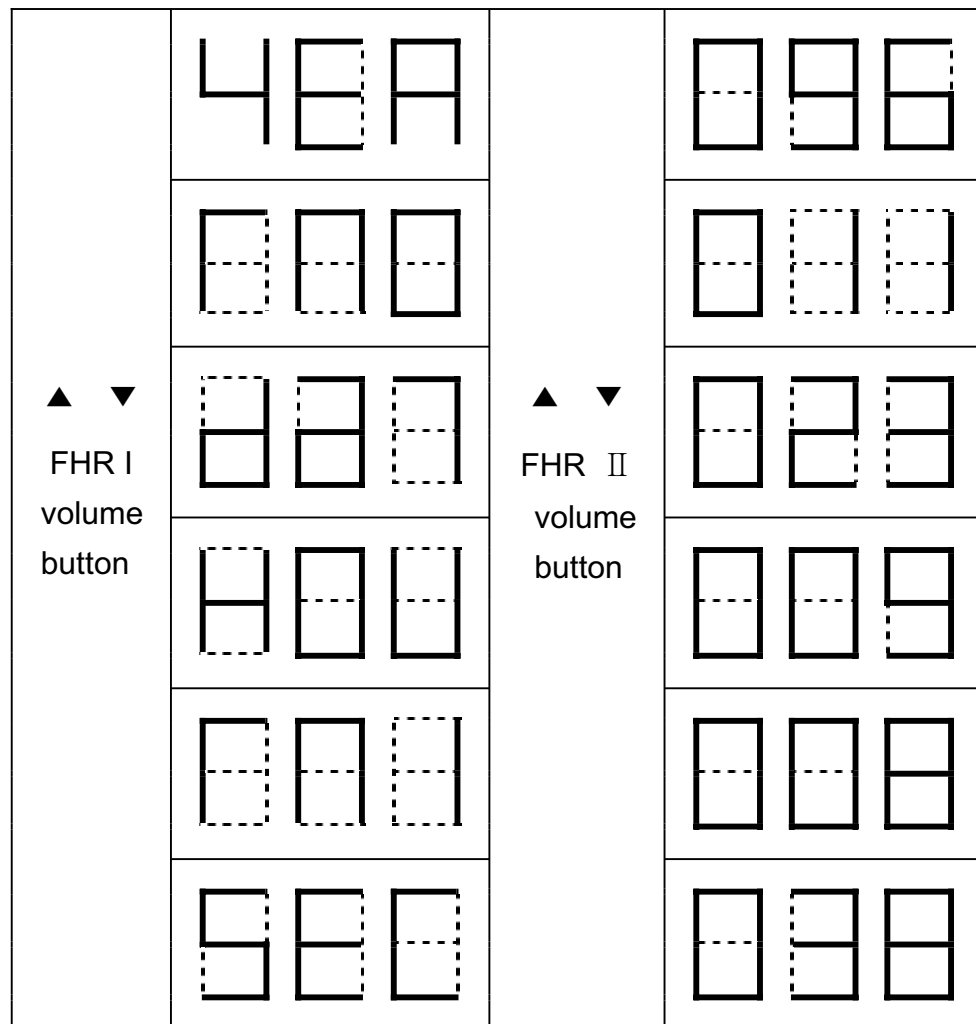
Subject	Item	Default setup value
Time and Date	Year	Current time
	Month	
	Day	
	hour	
	Minute	
	Second	
Record Speed	CM /MIN	3
FHR ALARM Parameter	Upper	190
	Lower	110
OFFSET Mode	-	OFF
ALARM Mode	-	ON

### 2) Set-Up Function

#### ♠ Time & Date Set-Up Function

- Push "CAL" button for over 2 seconds, then you can hear "Bee" sound saying ready to setup.
- Select "Year, Month, Day, Hour, Minute and Second" by FHR I volume button.
- Adjust the numeric value by FHR II volume button .

- If the volume button is pressed for over 2 seconds, the numeric value will be increased automatically..
- Push "REC" button to memorize the adjusted numeric value function. This step let you exit from time & date setup mode simultaneously.

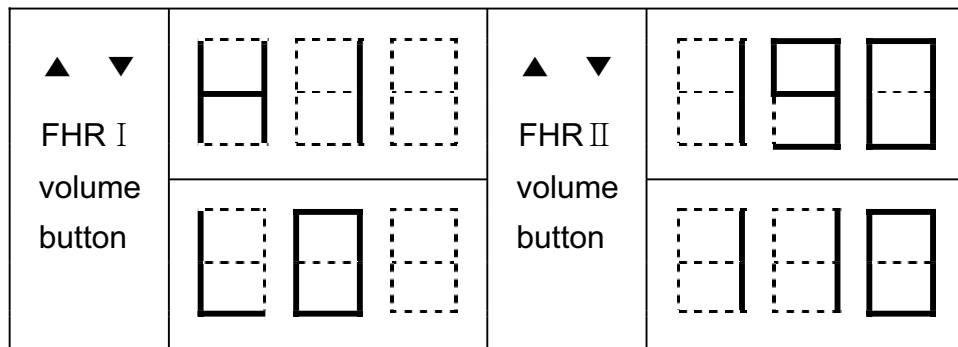


♣ FHR ALARM Set-Up Function

- Push "Alarm" button for over 2 seconds, and FHR alarm setup mode starts with "Bee" sound.
- Select upper & lower limit by FHR I volume up and down button.
- Adjust the numeric value by FHR II volume up and down button.

Allowable measurement range is from 50 to 240.

- If the volume button is pressed for over 2 seconds, the figure will increase automatically..
- After complete adjustment, one time pressing "REC" button will record modified information and exit from FHR Alarm Setup function.



#### PC Interface Set-up function

- PC 1:1 counter connection : Press "REF" button with Power on and switch the power on/off again, this introduce you PC 1:1 counter connection mode automatically.
- Central connection : Press "REC" button with Power on and switch the power on/off again, this introduce you central connection mode automatically.

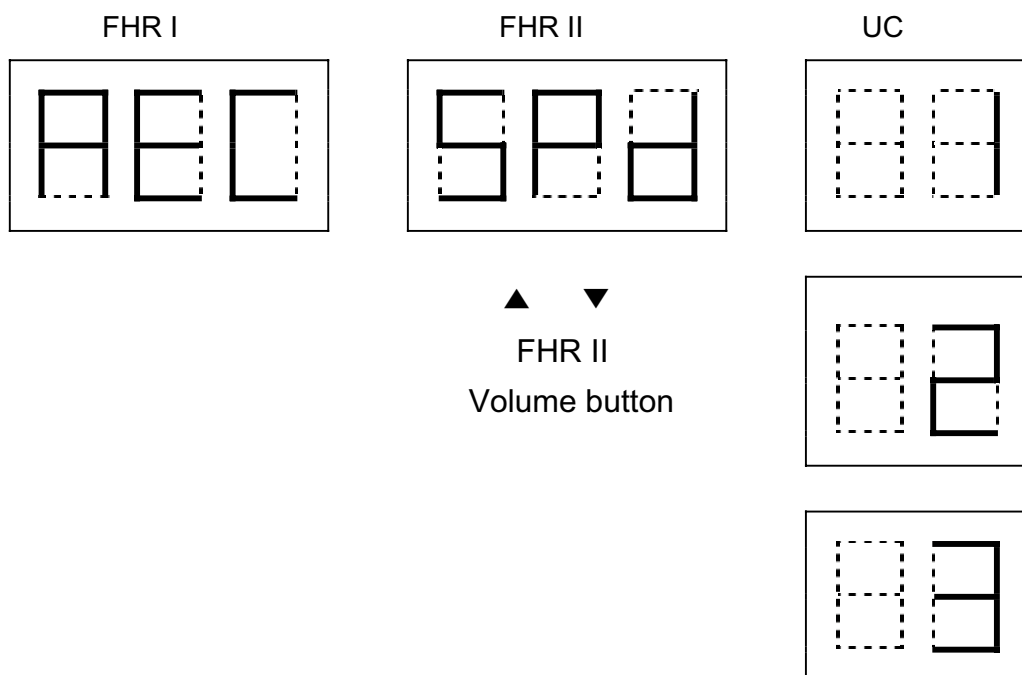
#### RECORD SPEED Set-Up function

- Pressing "REF" button (29) for more than 2 seconds, the record speed setup function will be executed with beep sound.
- The display panel of FHR I (20) shows "REC" and the display panel of FHR



II (25) shows "SPd" respectively.

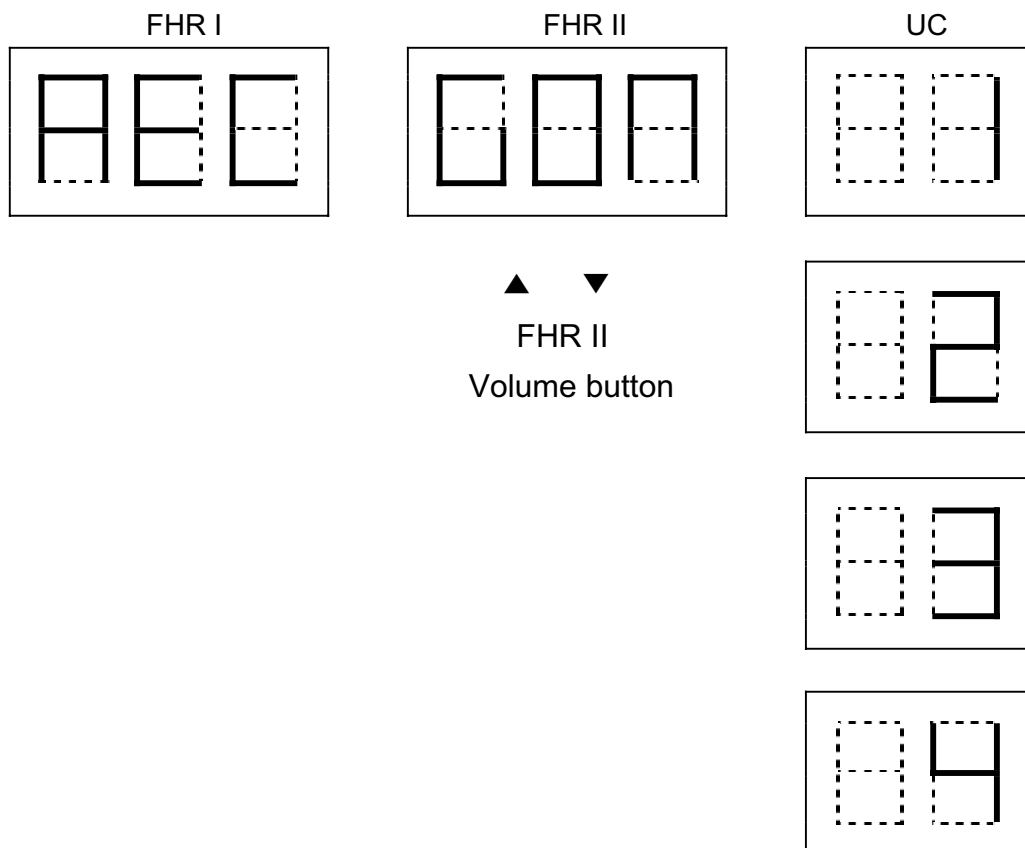
- The display panel of UC (28) shows "3".
- Select pre-set 1, 2, or 3 for record speed by FHR II volume up and down button .
- After complete adjustment, one time pressing "REC" button will record modified information and exit from Record Speed Setup function.



#### ♠ Record CONTRAST Set-Up Function

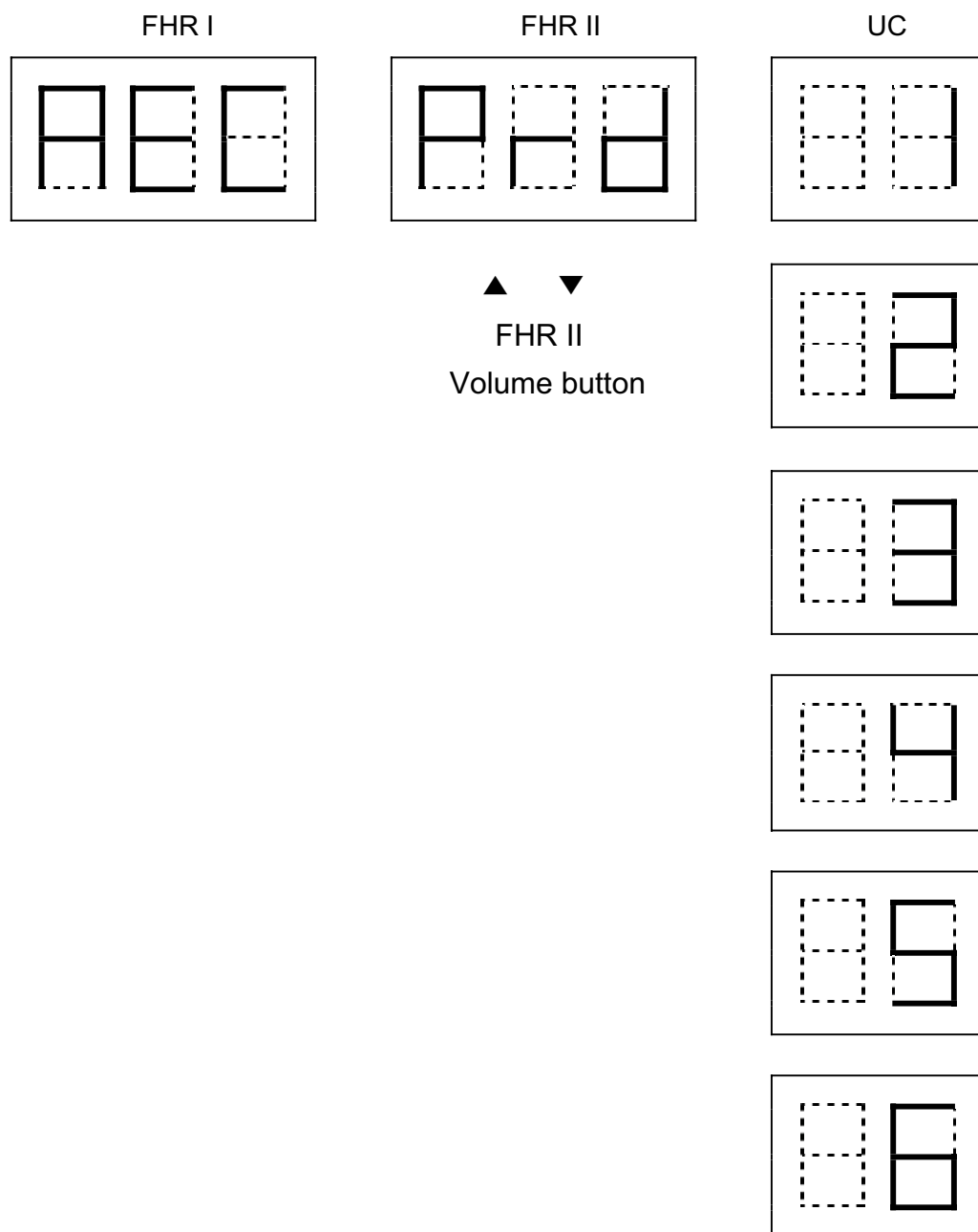
- Push "REF" button for over 2 seconds, then record contrast set-up mode starts with "Bee" sound.
- The display panel of FHR I shows "REC" and the display panel of FHR II shows "Con" respectively.
- The display panel of UC shows "1".

- Select the pre-set value of record contrast value among 1, 2, 3 and 4 by FHR II volume up and down button.
- After complete adjustment, you will be exit from record contrast setup mode by pressing "REC" button for one time.
- Each of pre-set values are as follows.
  - 1 : normal
  - 2 : normal X 2
  - 3 : normal X 3
  - 4 : normal X 4



♣ Auto record time setup function

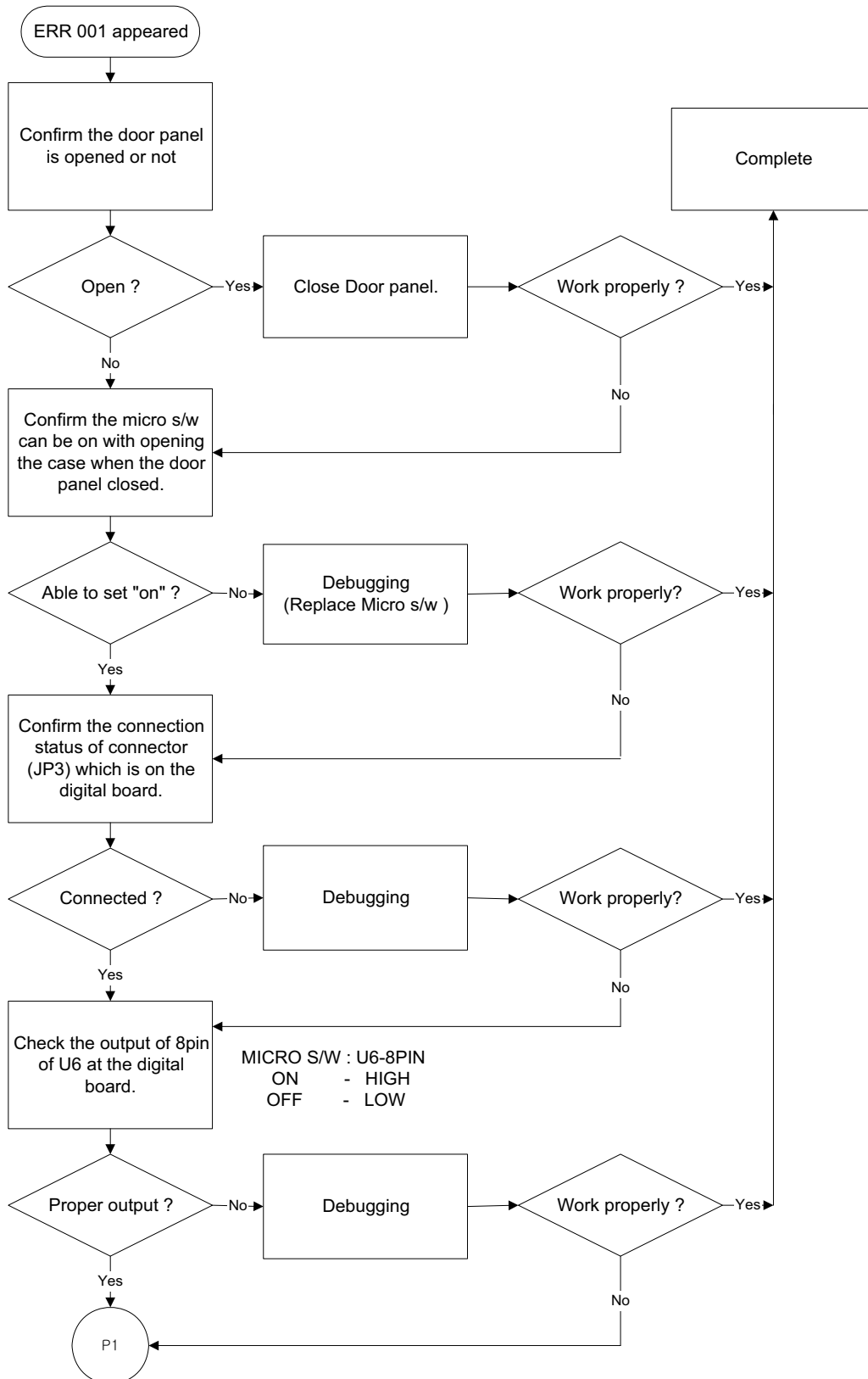
- Push "REF" button for over 2 seconds, auto record time setup function will be executed with "Bee" sound.
- The display panel of FHR I shows "REC" and the display panel of FHR II shows "Prd" respectively.
- The display panel of UC shows "0".
- Select among the pre-set value of 0, 1, 2, 3, 4, 5, 6 by FHR II volume up and down button.
- After complete adjustment, pressing "REC" button will introduce you to exit from auto record time setup mode with memorizing the adjusted information.
- Each setup values are as follows.
  - 0 : continuous
  - 1 : 10 minutes
  - 2 : 20 minutes
  - 3 : 30 minutes
  - 4 : 40 minutes
  - 5 : 50 minutes
  - 6 : 60 minutes

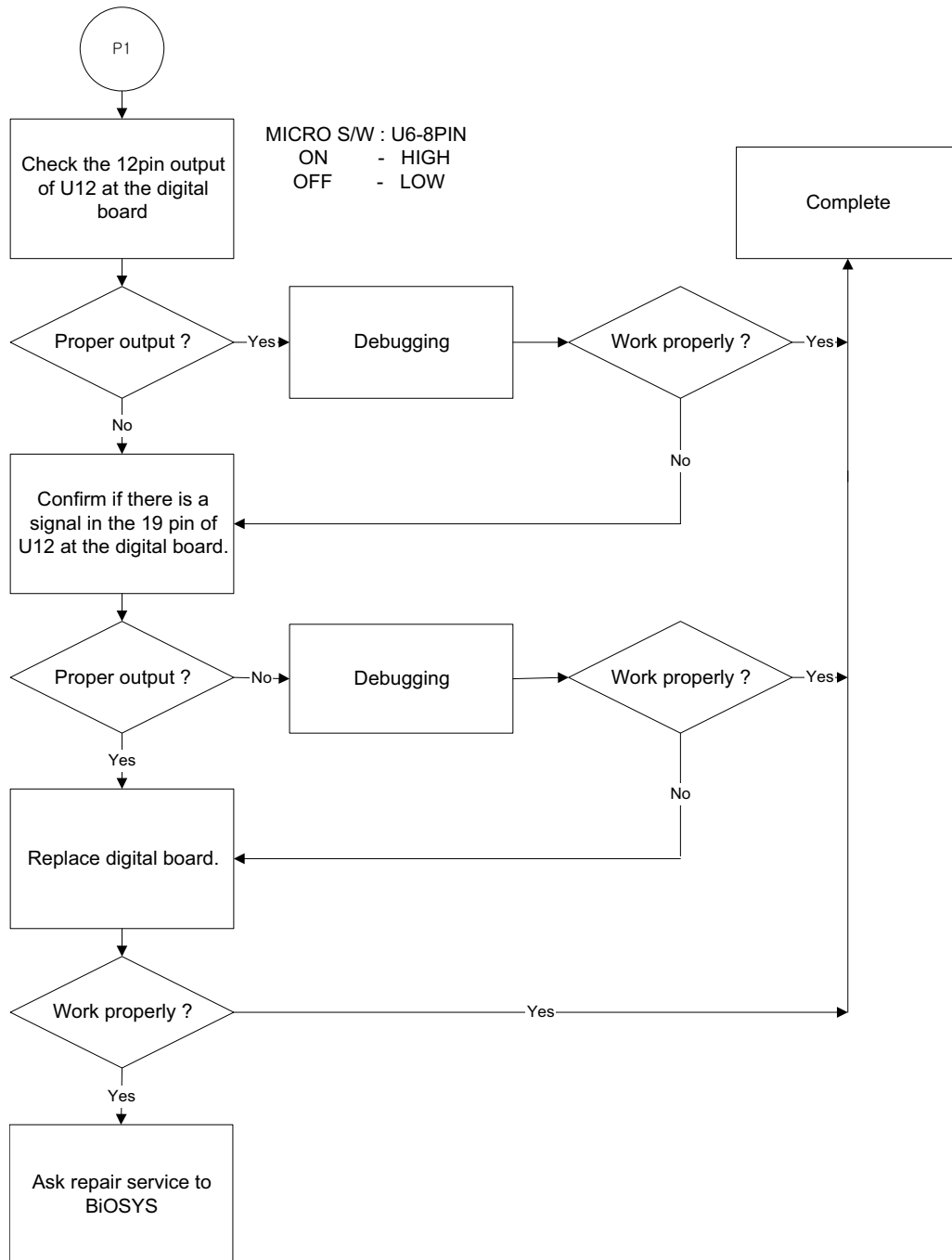


## 7.TROUBLE SHOOTING

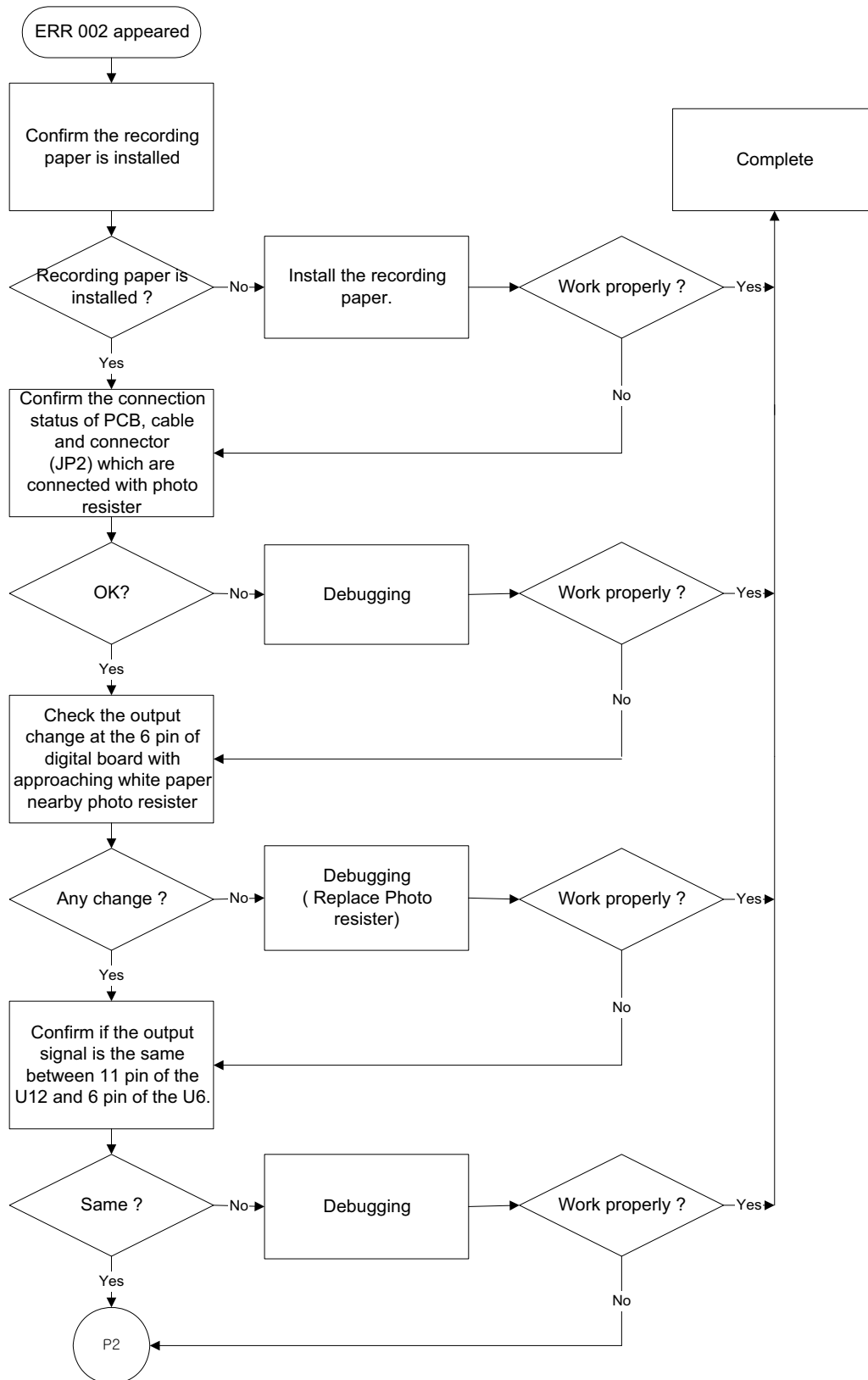
NO	symptom	Refer PAGE
#1	ERR 001	51
#2	ERR 002	53
#3	ERR 003	54
#4	ERR 004	55
#5	Key interface unable	57
#6	Paper unable to out	59
#7	Print unable	61
#8	Power ON unable	62
#9	Three times of Ready sign twinkle and system shut-down	63
#10	Only "Bee" sound but no display when Power ON	64
#11	No audio	65
#12	The numeric value of UC or HR is not change or update	66
#13	Display unable	67
#14	Marker is not work	68
#15	PC interface unable	69

## #1. ERR 001

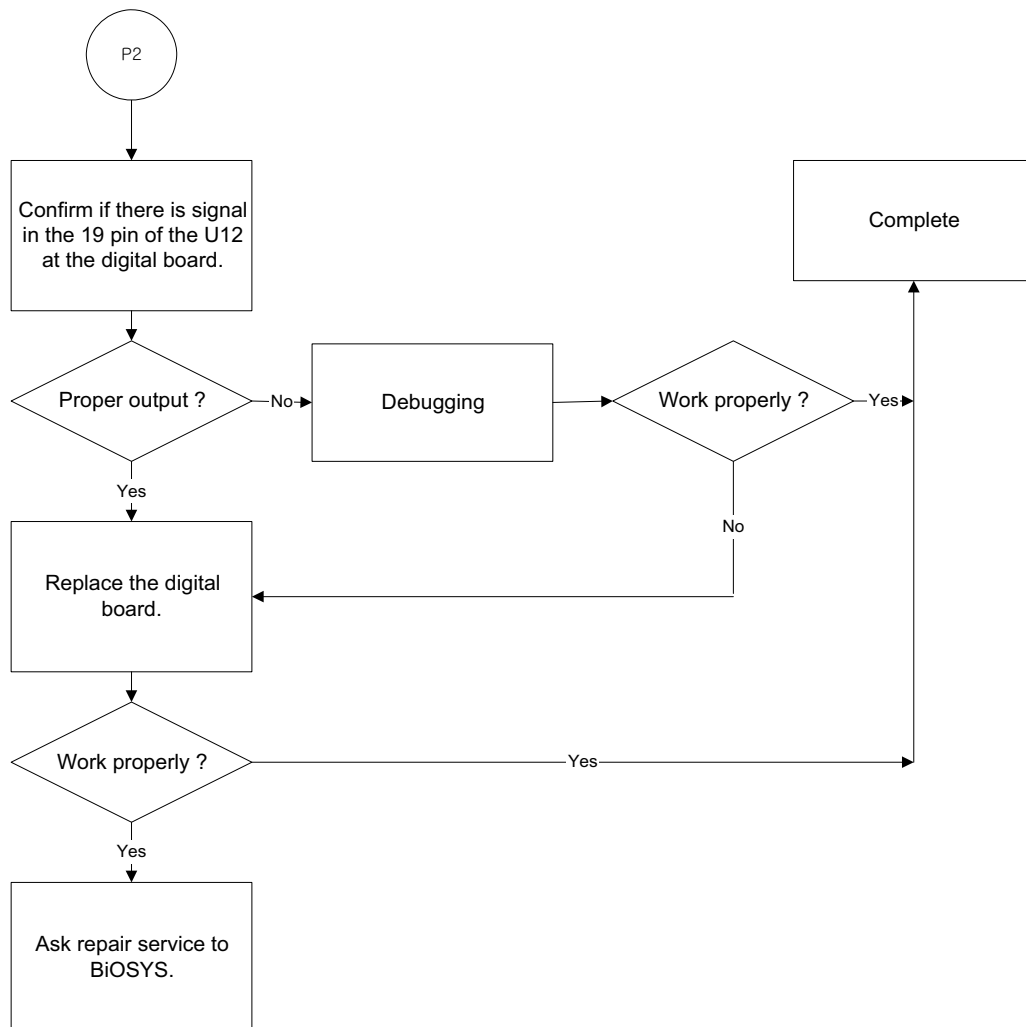




## #2. ERR 002



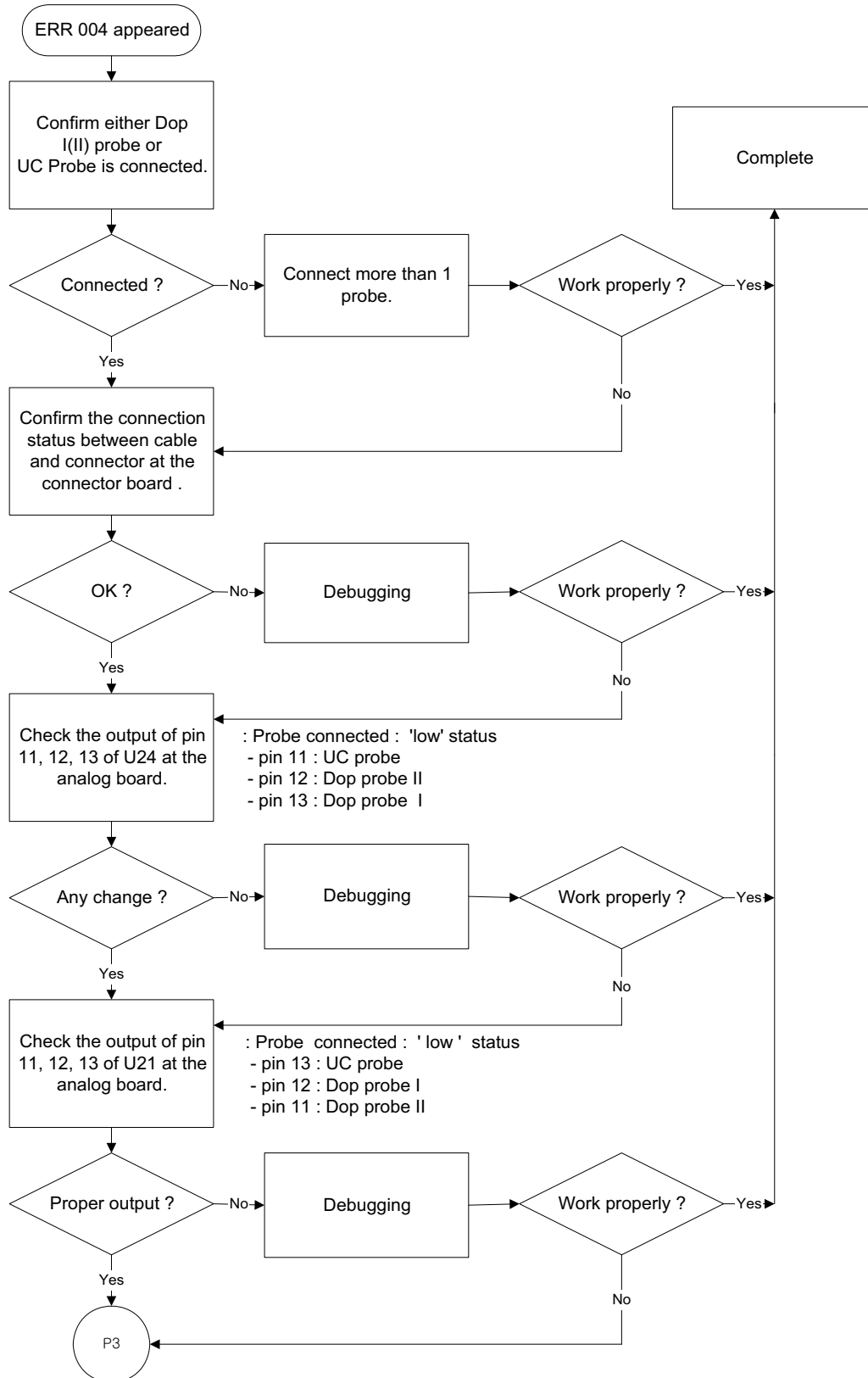


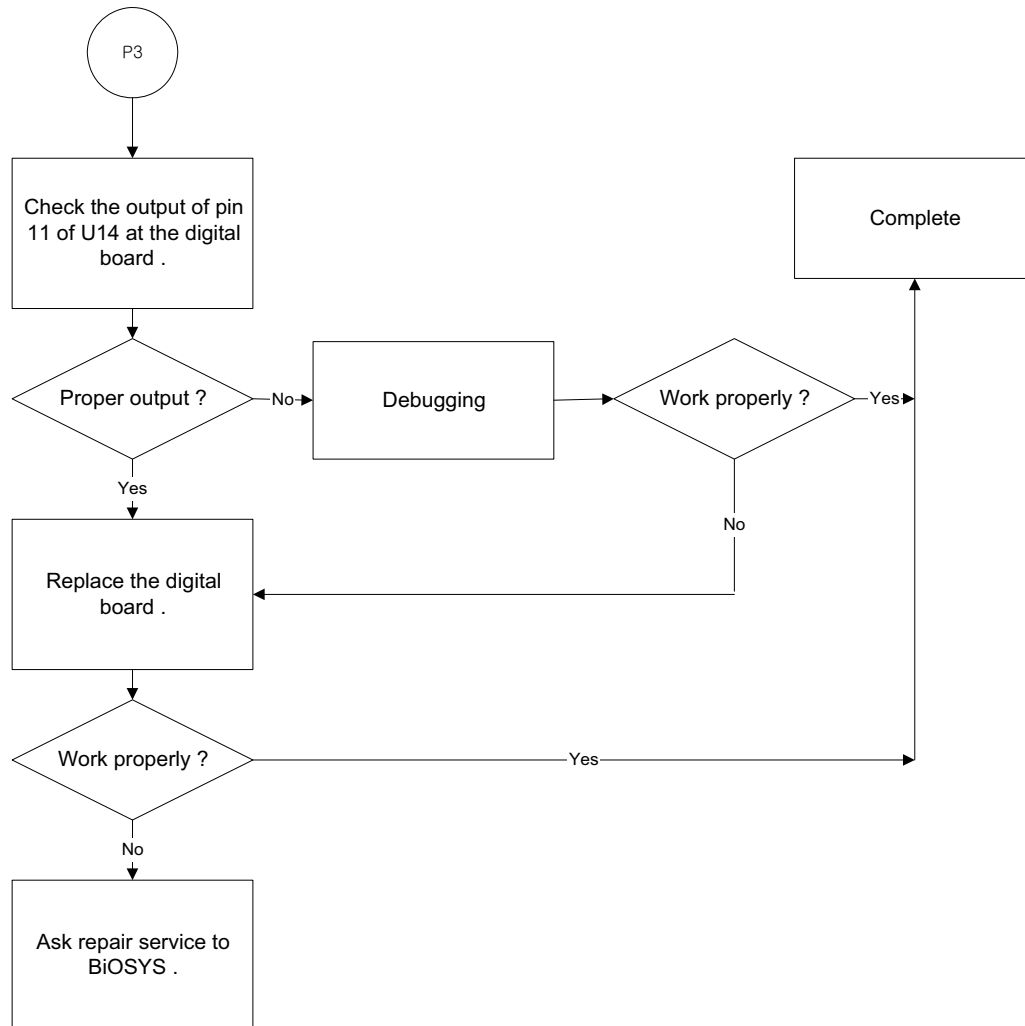


**#3. ERR 003**

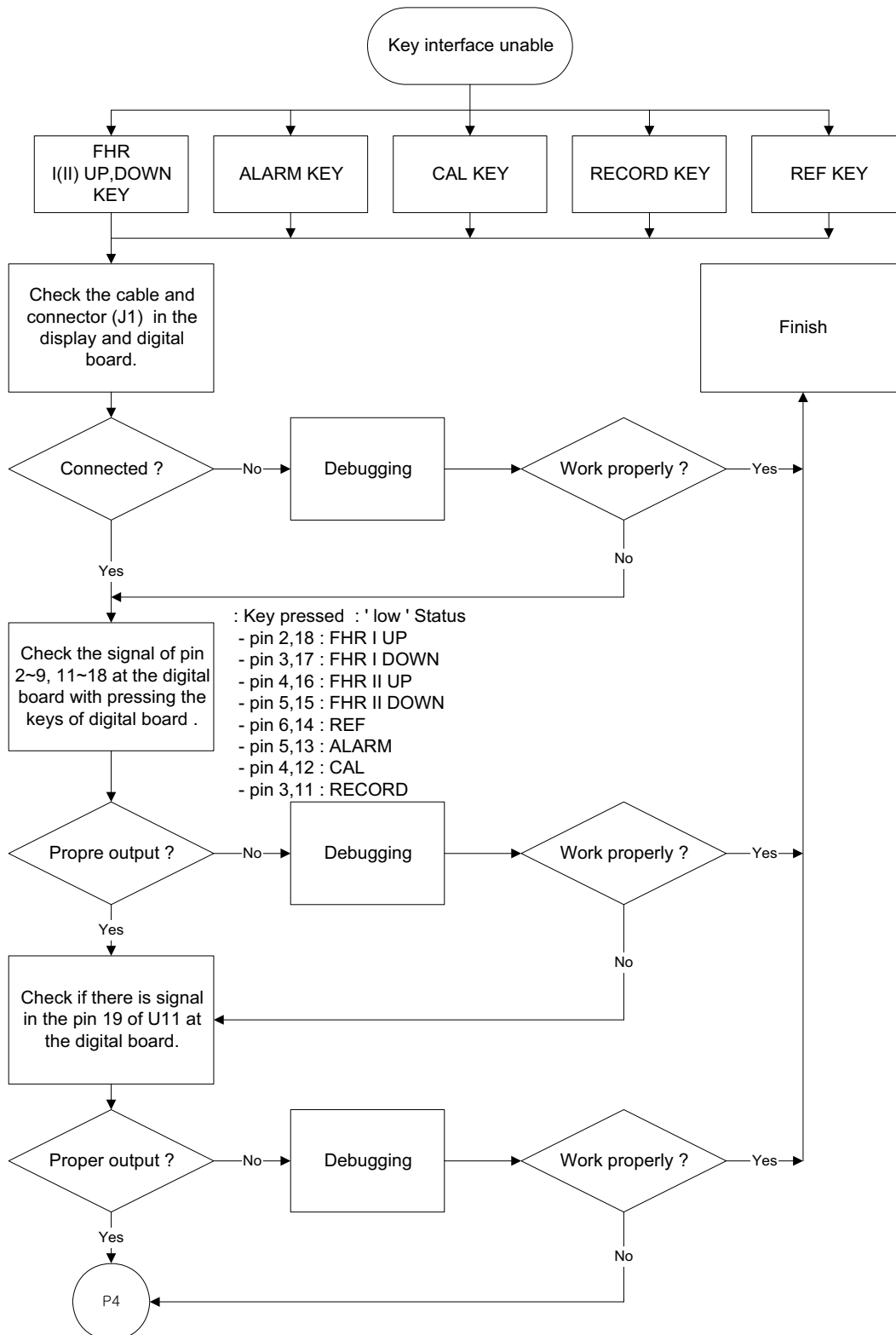
ERR 003 will appear in case of ERR 001 and ERR002 are happened simultaneously.

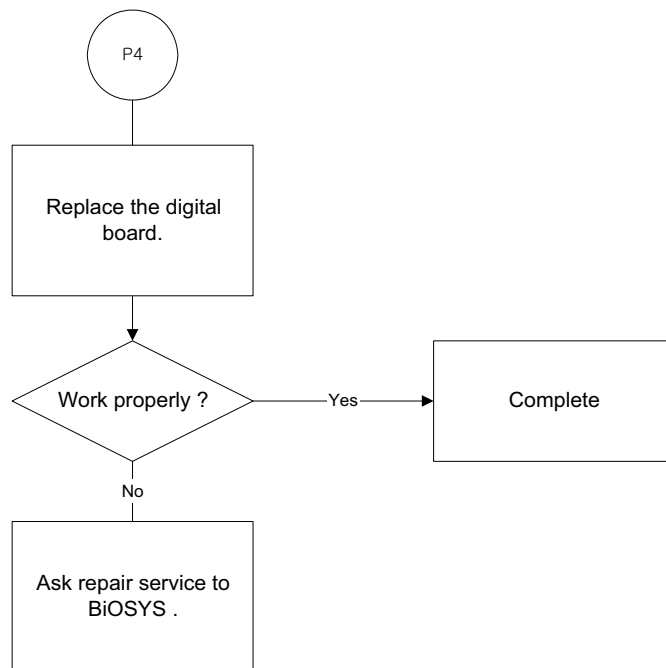
#### #4. ERR 004



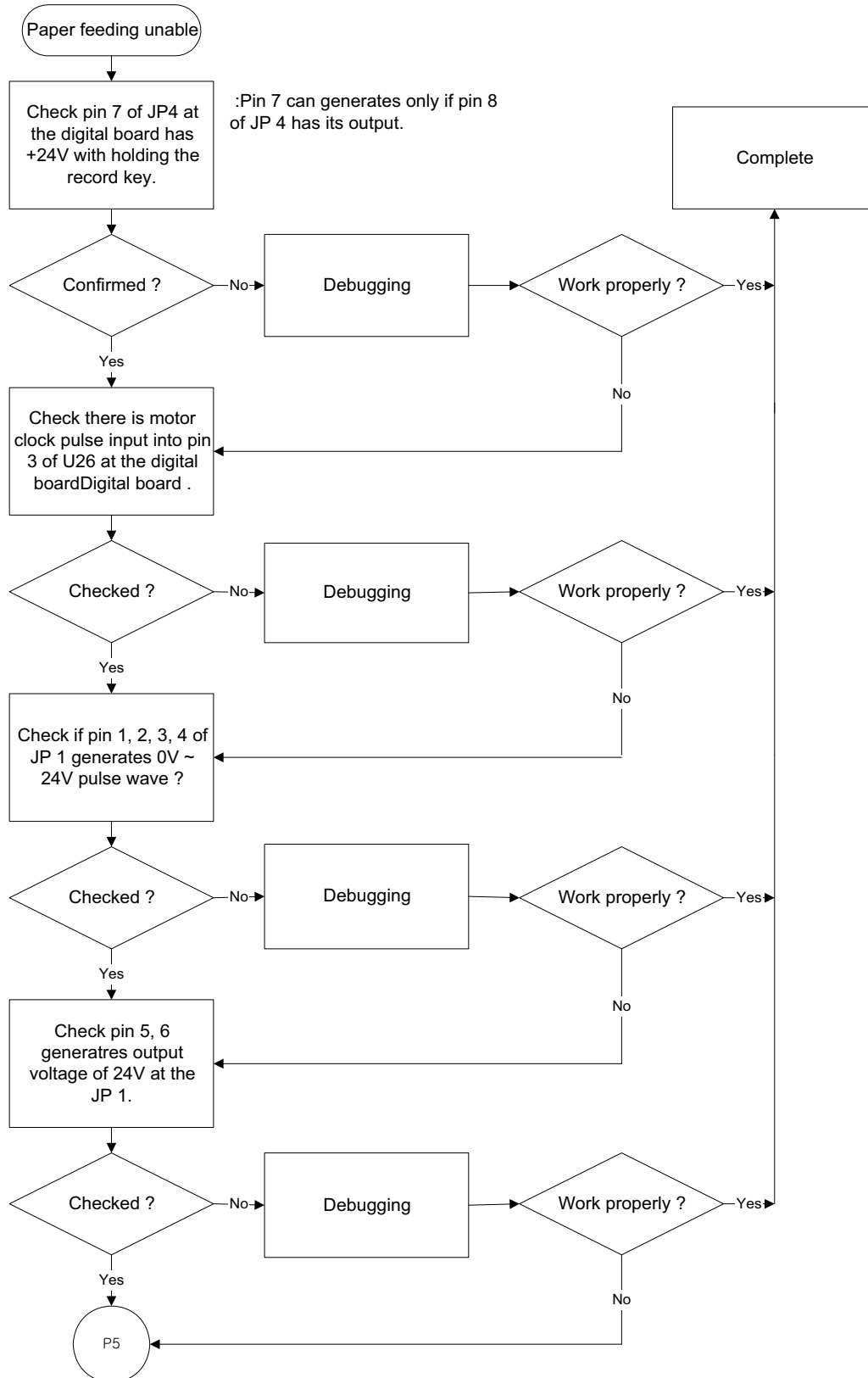


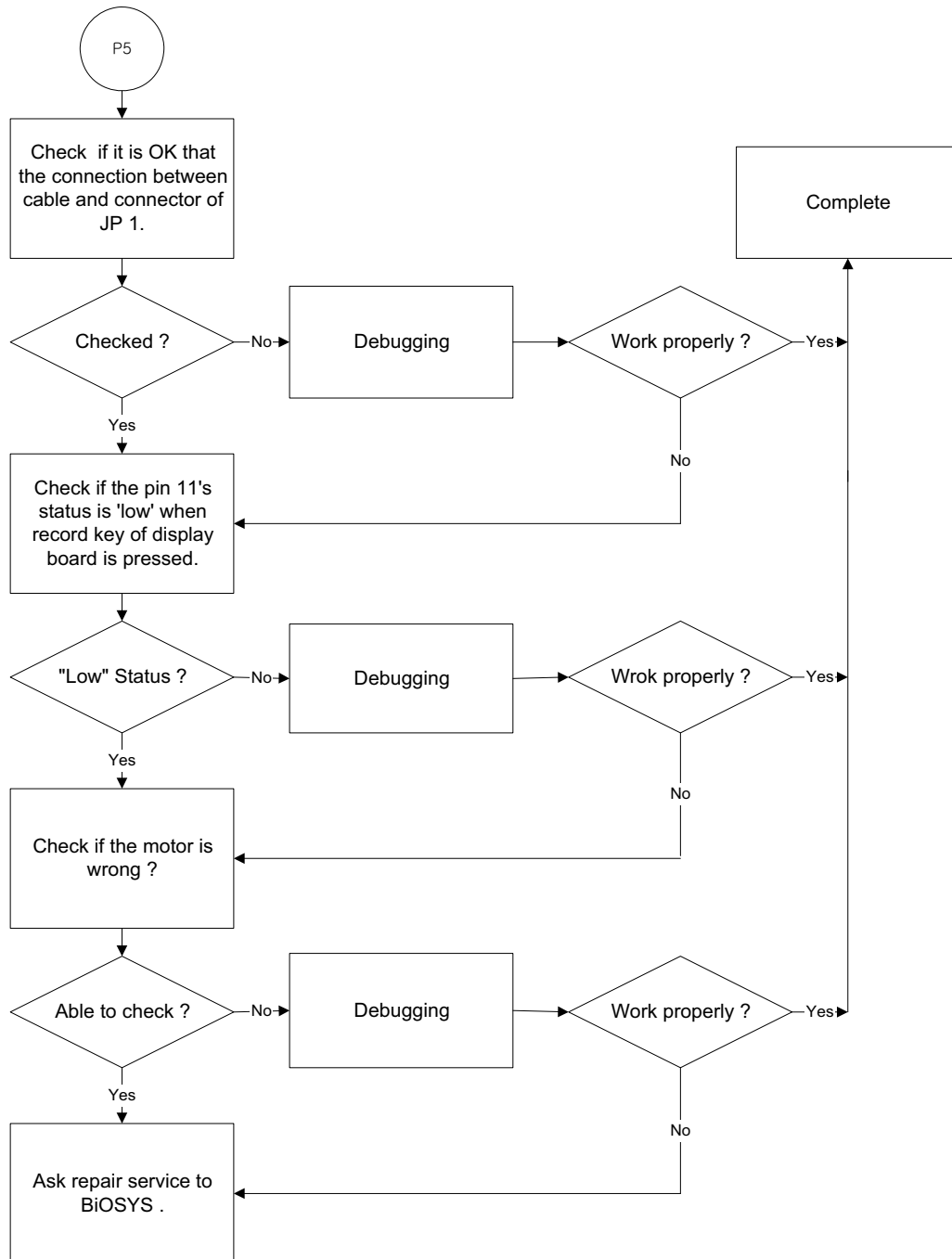
## #5. Key interface





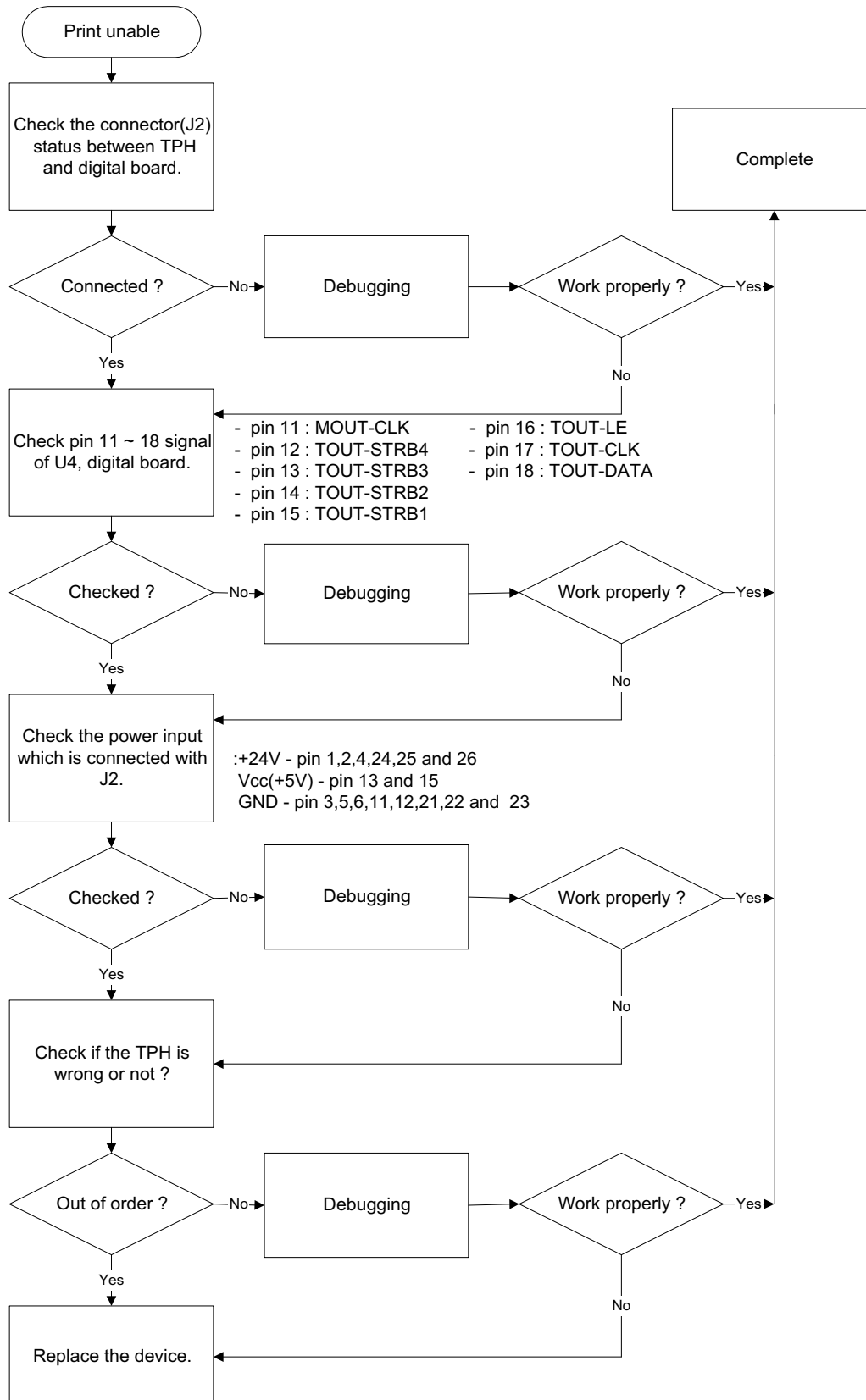
## #6. Paper feeding unable

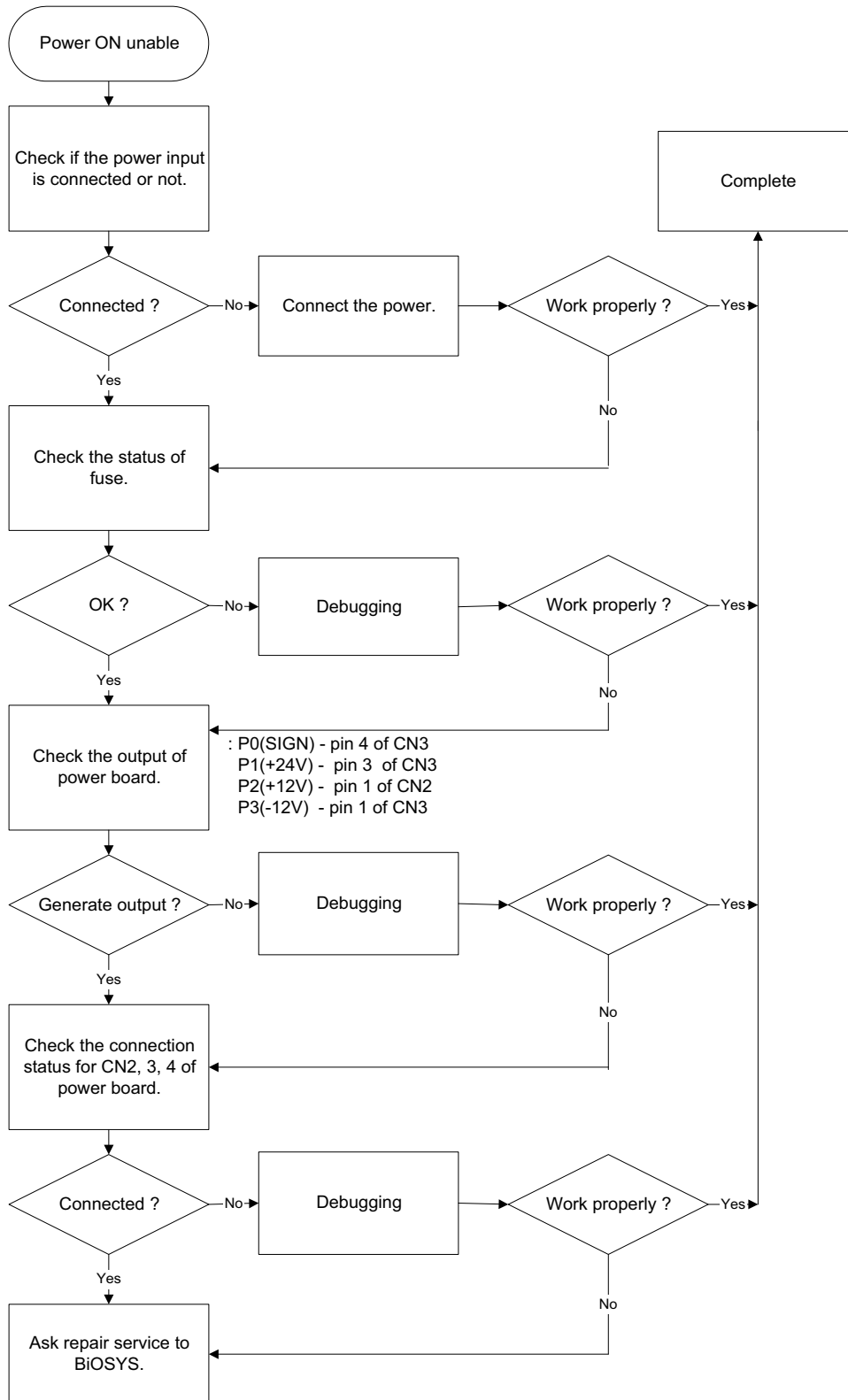


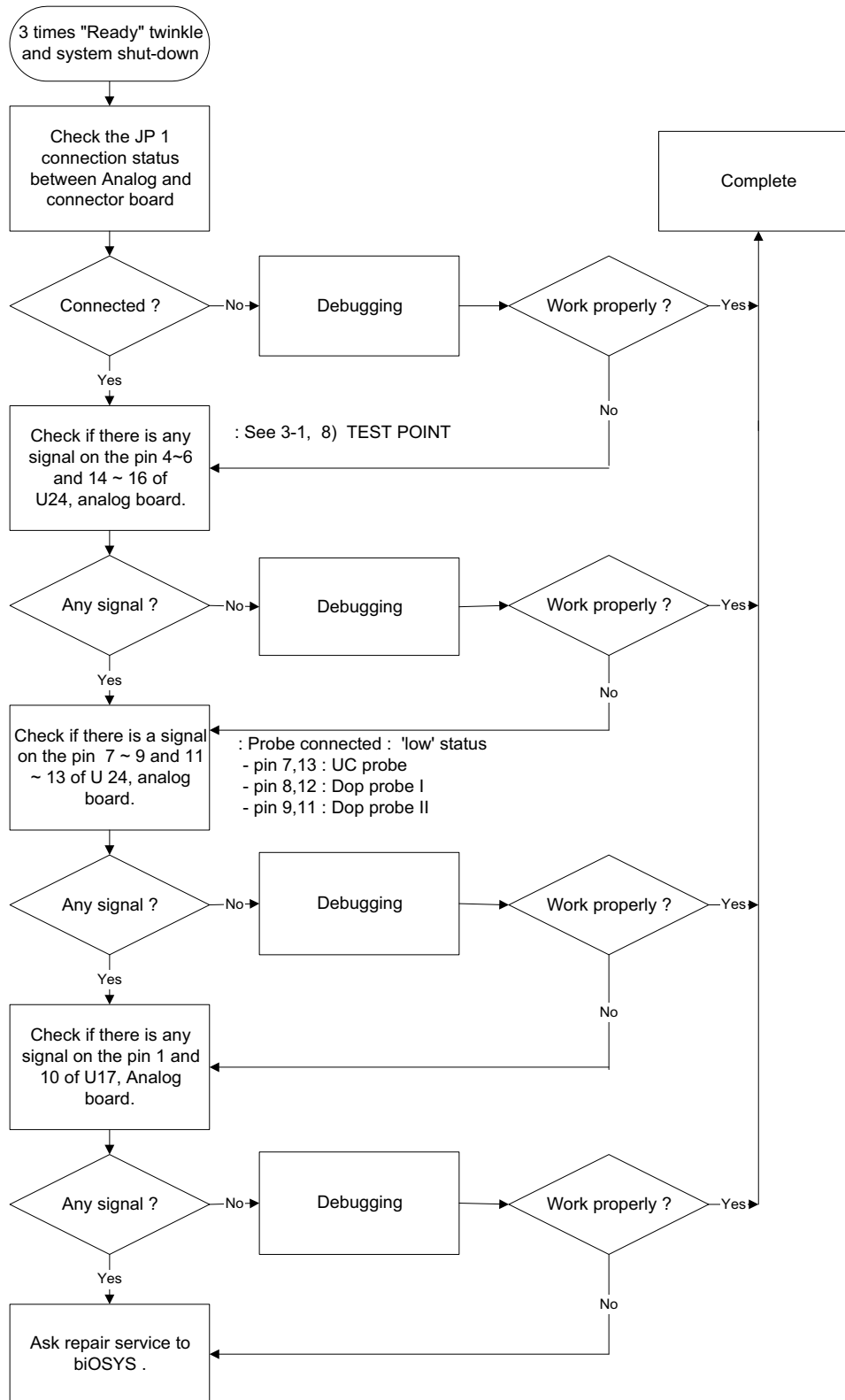


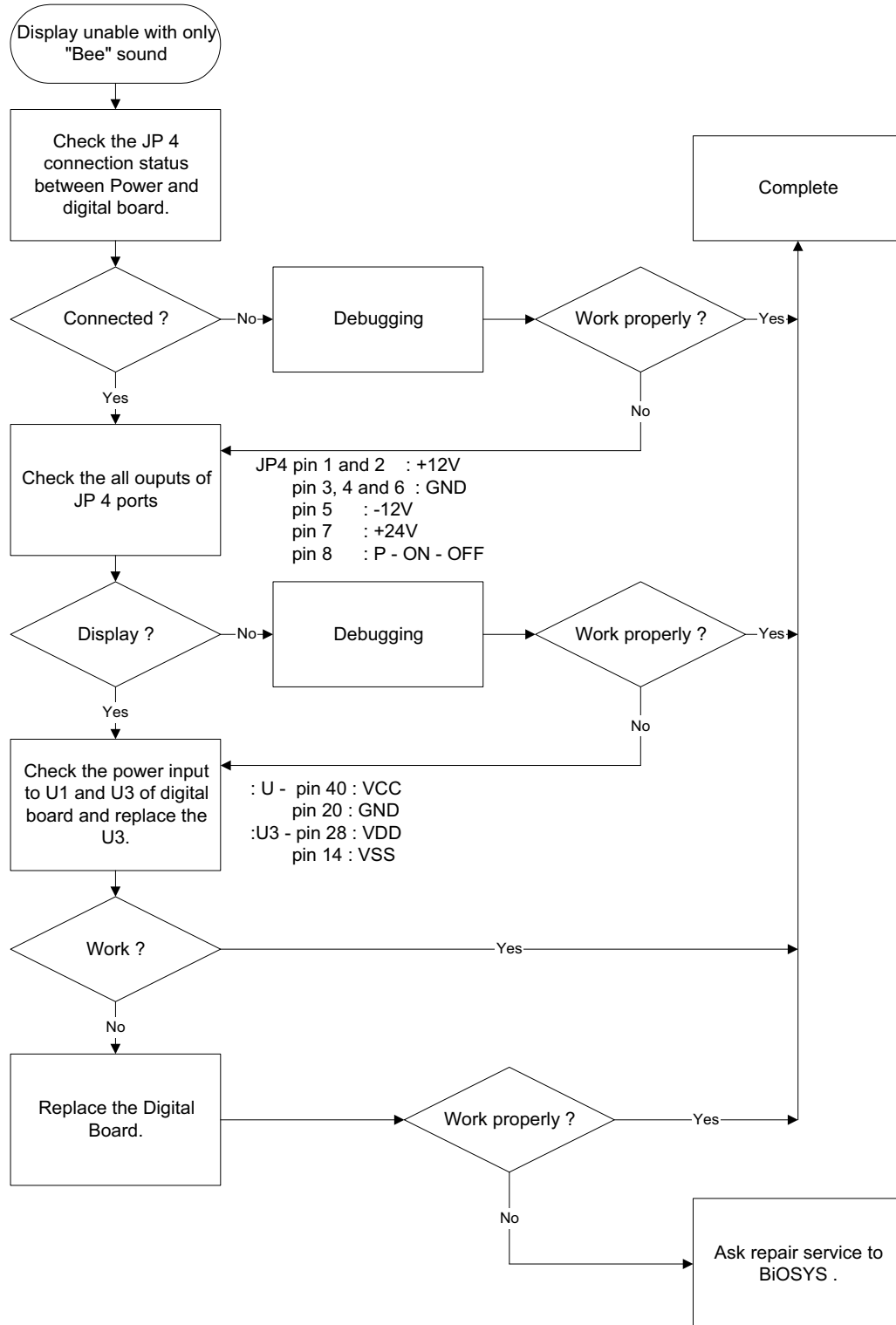


## #7. Print unable

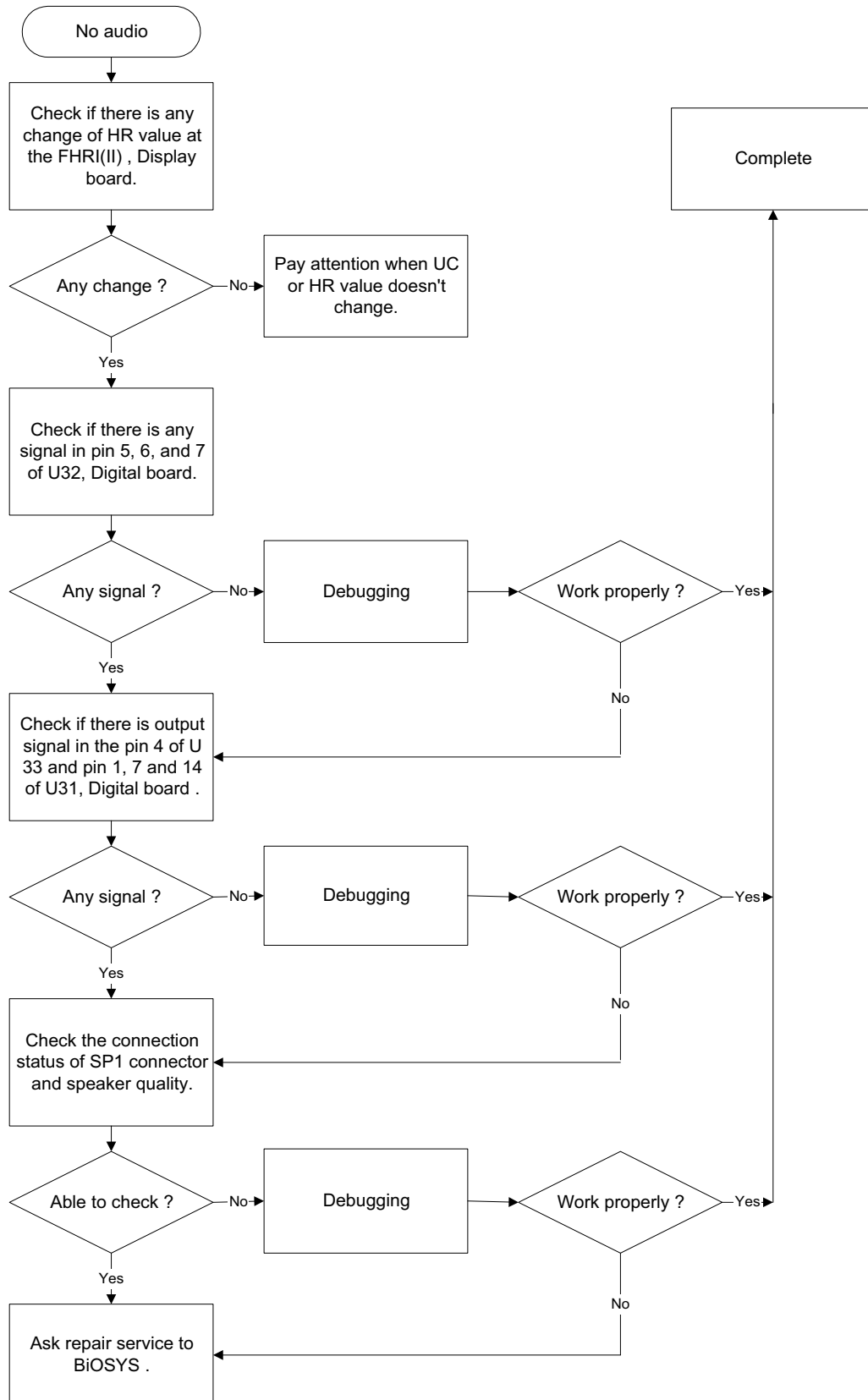


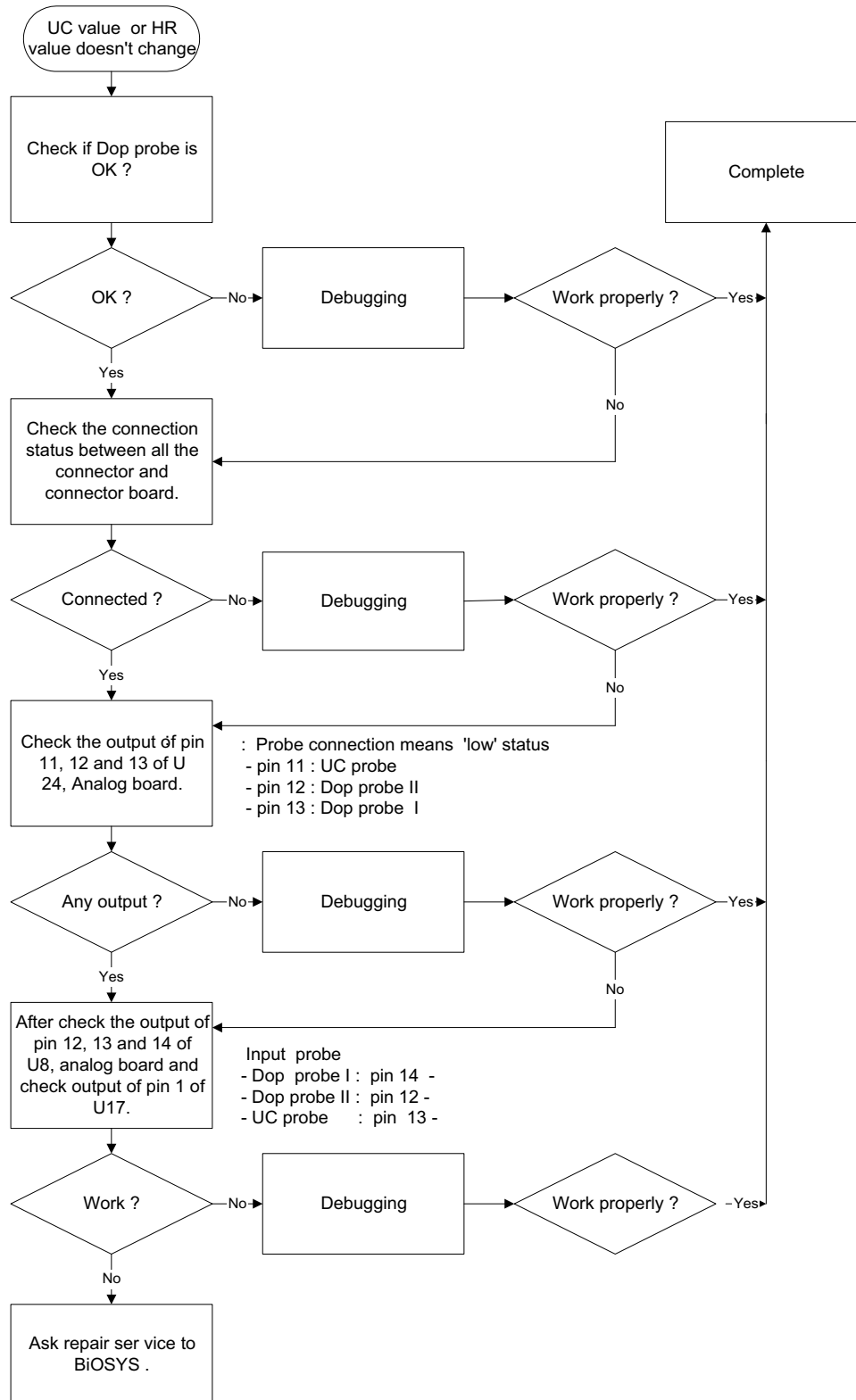
**#8. Power ON unable**

**#9 . 3 times of "Ready" twinkle and system shut-down**

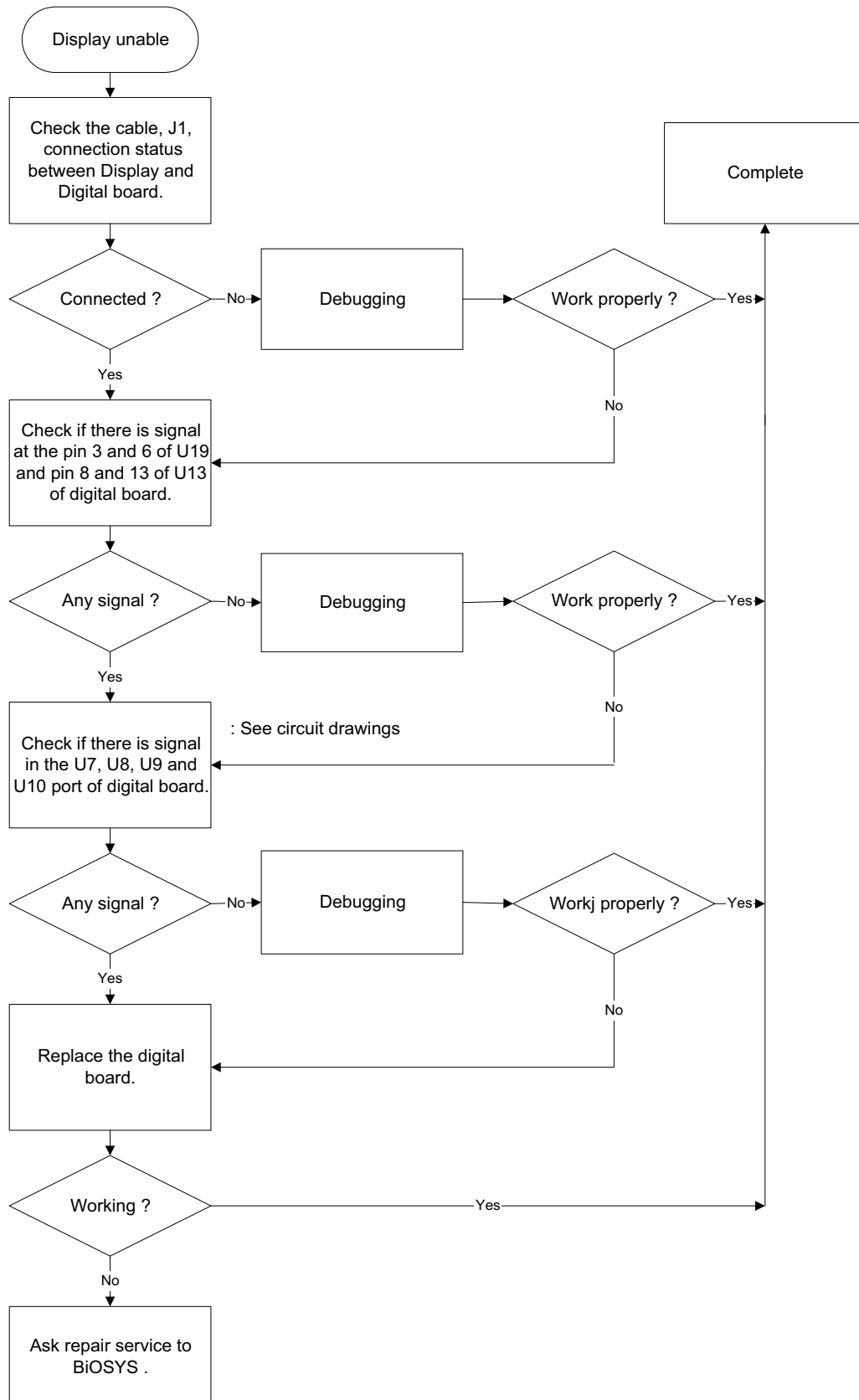
**#10. Display unable but only "Bee" sound is detected when power on**

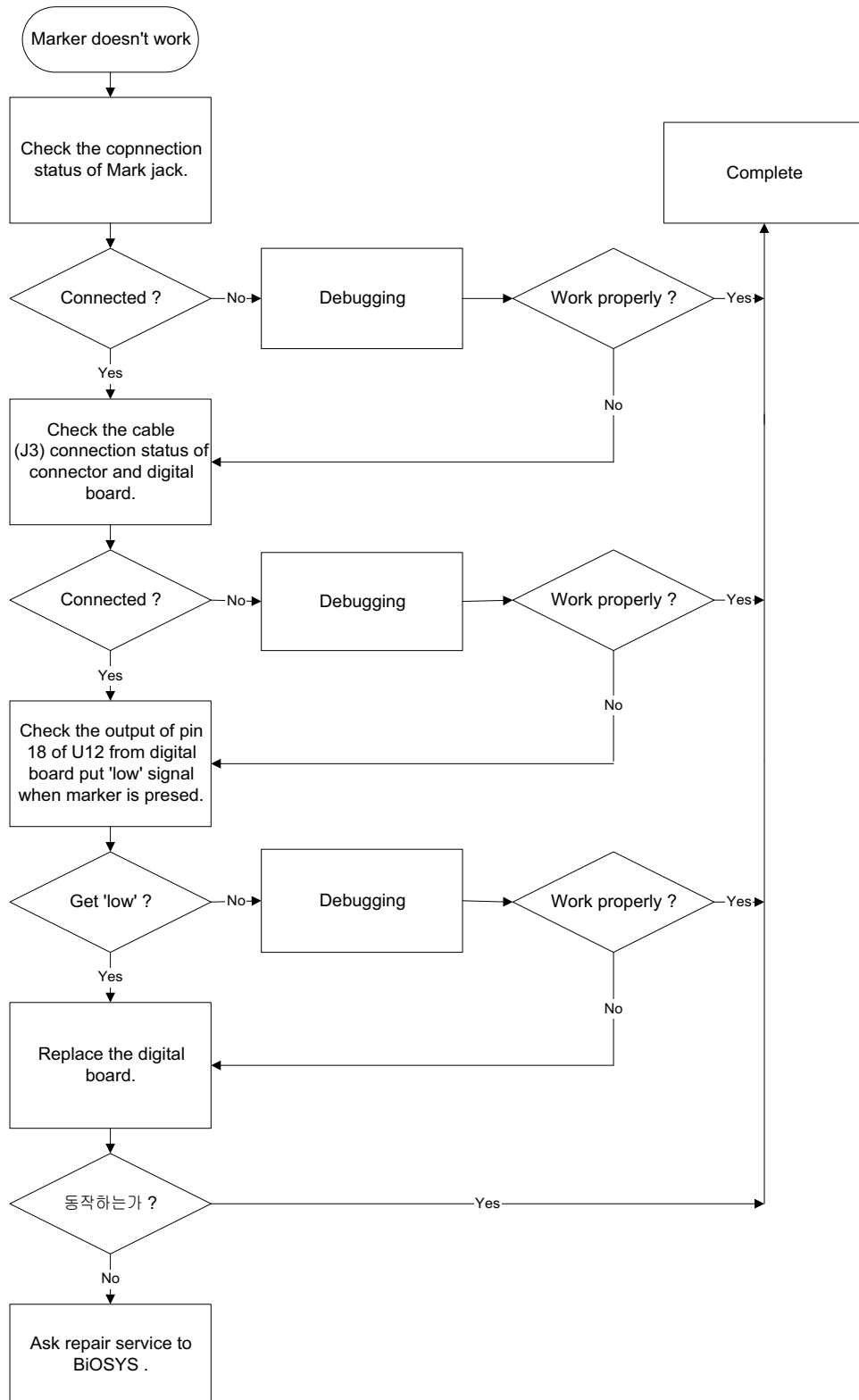
# #11. No audio



**#12. UC value and HR value doesn't change**

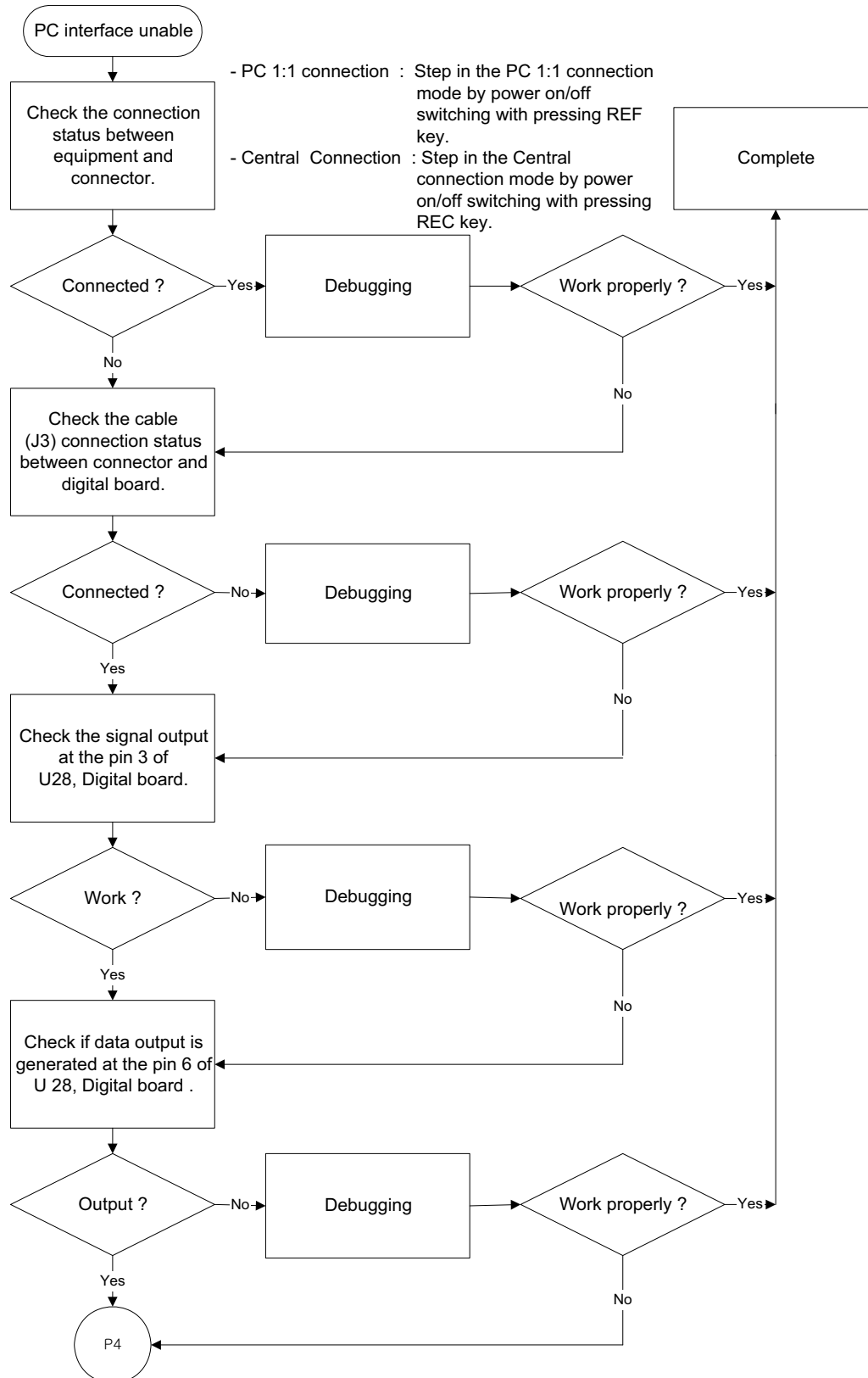
### #13. Display unable

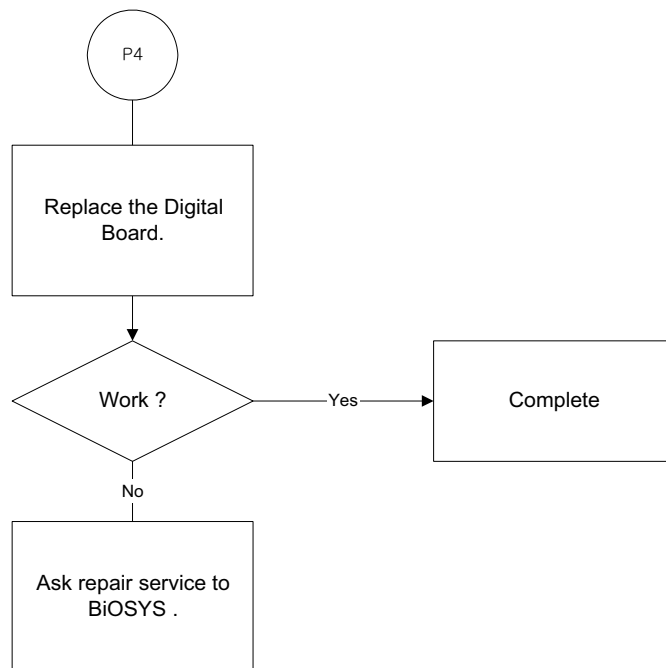


**#14. Marker doesn't work**



# #15. PC interface unable





## 8.SERVICE PART LIST

Level	PART IDENTIFIER	DESCRIPTION	QTY
0	SYSTEM-IFM500	IFM-500 SYSTEM & ACCESSRY	SE
1	ACCY-250	IFM-500 ACCESSARY ASS'Y	SE
.2	250-M-HLD-4021A	IFM-500 PROBE HANGER	EA
.2	250-Z-BLT-4011A	IFM-500 PROBE BELT	EA
.2	ADT-AC-0	ADUPTER JACK 220 TO 110	EA
.2	AY-PRB-250	IFM-500 PROBE ASS'Y	SE
..3	AY-PRB-250D	IFM-500 DOP PROBE ASS'Y	SE
...4	PCB-250-DPRB-01	IFM-500 DOP PROBE PCB	EA
...4	SEN-250D	IFM-500 7-SEG DOP SENSOR	EA
..3	AY-PRB-250U	IFM-500 UC PROBE ASS'Y	SE
...4	BD-250-UC-01	IFM-500 UC PROBE BD-ASS'Y	SE
..3	PRB-250M	IFM-500 MARK S/W ASS'Y	SE
.2	CORD-PW03-B	AC 250V PWR CORD TUV	EA
.2	FUSE-1A250V-TLS	FUSE 1A 250V T-LAG 20MM	EA
.2	GEL-USD-B	ULTRASOUND GEL 0.25L	EA
.2	OPMNL-250	OP MANUAL IFM-500	EA
.2	PAPER-250-T	IFM-500 THERMAL PAPER	EA
.2	WH-250-01	ASS'Y EARTH CABLE IFM-500	SE
1	AY-SYS-250	IFM-500 SYSTEM ASS'Y	SE
.2	250-A-FNT-4011	IFM-500 FRONT ASS'Y	SE
..3	250-A-KBD-4011	IFM-500 KEY BOARD ASS'Y	SE
...4	BD-250-KBD-01	IFM-500 KEY BOARD PCB ASS'Y	SE
...4	SW-MS2215-03	MICRO S/W MS2215-03	EA
...4	TPH-8T26C	TPH 8T26C SAMSUNG	EA
....5	PCB-250-SEN-01.	IFM-500 PAPER SENSOR PCB	SE
....5	MOT-PF42-48B1	STEP MOTOR NPM PF42-48B1	EA
..3	BD-250-ANA-01	IFM-500 ANALOG BOARD ASS'Y	SE
..3	BD-250-CONT-01	IFM-500 CONNECTOR BOARD ASS'Y	SE
..3	BD-DIGI-01	IFM-500 DIGITAL BOARD ASS'Y	SE

## ANALOG BOARD

Components	DESCRIPTION	LOCATION NUMBER
IC	LM7806	U1
	LM7805	U2
	LM7906	U3
	LM741	U5,U6,U23
	TL064	U7,U9,U21,U22
	4053	U8,U10
	74HC393	U11,U12
	16L8	U13,U14
	74HC08	U15
	TL062	U16
	AD1876	U17
	4051	U18
	MC1496	U19,U20
	74HC245	U24,U25
RESISTER	10 $\Omega$ 5% 250mW	R77,R78,R79,R80,R81,R82,R86,R91,R93,R94,R109,R110,R111
	100 $\Omega$ 5% 250mW	R18,R42,R85,R90,R117
	1K $\Omega$ 5% 250mW	R7,R8,R15,R19,R20,R33,R39,R43,R44,R57,R87,R92
	10K $\Omega$ 5% 250mW	R9,R24,R48,R67,R68,R69,R83,R88
	100K $\Omega$ 5% 250mW	R4,R10,R34,R74
	120K $\Omega$ 5% 250mW	R107,R100
	1.5K $\Omega$ 5% 250mW	R17,R41
	18K $\Omega$ 5% 250mW	R37,R13
	20 $\Omega$ 5% 3W	R114
	2K $\Omega$ 5% 250mW	R5,R6,R32,R56
	20K $\Omega$ 5% 250mW	R27,R51,R58,R59,R63,R64,R97,R104
	220 $\Omega$ 5% 250mW	R75

	22K $\Omega$ 5% 250mW	R12,R36,R119
	3K $\Omega$ 5% 250mW	R71,R73
	30K $\Omega$ 5% 250mW	R2,R3,R95,R98,R101,R102, R105,R108
	300K $\Omega$ 5% 250mW	R29,R30,R53,R54
	33 $\Omega$ 5% 250mW	R112,R113,R118
	330 $\Omega$ 5% 250mW	R76
	3.3K $\Omega$ 5% 250mW	R116
	3.9K $\Omega$ 5% 250mW	R22,R23,R46,R47
	47 $\Omega$ 5% 250mW	R60,R61,R62,R65
	470 $\Omega$ 5% 250mW	R11,R14,R35,R38
	4.7K $\Omega$ 5% 250mW	R25,R49,R66,R115
	47K $\Omega$ 5% 250mW	R99,R106
	560 $\Omega$ 5% 250mW	R70,R72
	6.8K $\Omega$ 5% 250mW	R21,R45
	68K $\Omega$ 5% 250mW	R26,R28,R31,R50,R55,R96, R103
	69K $\Omega$ 5% 250mW	R52
	820 $\Omega$ 5% 250mW	R16,R40
	8.2K $\Omega$ 5% 250mW	R84,T89
RESISTOR ( VR )	10K $\Omega$	VR2,VR3,VR4,VR5
CAPACITOR,CERAMIC	101 10% 50V	C23,C51
CAPACITOR,ELCTIT	1 $\mu$ F 20% 20V	C113,C120
	220 $\mu$ F 20% 20V	C5,C6,C7,C8,C10,C107, C114,C151
	47 $\mu$ F 20% 20V	C60,C83,C84,C86,C89,C90, C92,C95
CAPACITOR,MONO	104 10% 50V	C1,C2,C3,C4,C9,C12,C14C1 5, C17,C18,C19,C20,C21,C25,C 30,C32,C33,C37,C38,C44,C4 5,C49,C53,C57,C59,C64,C65 ,C71,C72,C77,C78,C79,C80, C81,C82,C85 C91,C97,C98,C100,C102,C1

		04,C106,C126,C152,C200,C201, C202,C203,C204,C205,C206, C207,C208,C209,C210,C224,
CAPACITOR,MYLAR	102 5% 50V	C35,C36,C62,C63,C93,C94
	103 5% 50V	C22,C27,C29,C41,C42,C46,C47,C50,C55,C68,C69,C73,C74,C76,C99,C103,C221, C225,C226
	104 5% 50V	C31,C34,C58,C61,C87,C88
	222 5% 50V	C26,C54,C112,C119
	223 5% 50V	C28,C56,C101,C105,C111,C118
	333 5% 50V	C40,C67,C108,C115
	472 5% 50V	C39,C43,C48,C66,C70,C75, C109,C110,C116,C117
TRANSISTOR	TL431	Q1,D10
	2N3904	Q3,Q5,Q6,Q7,Q8,Q9,Q10,Q11
	BS170	Q2,Q4
IFT TRANS	IFT10.7M	T1,T2,T3,T4
CHOKE COIL	30uH / 1A	L1,I2
ARRAY RESISTOR	4.7K $\Omega$ 5% 250mW 9PIN	PR1
CONNECTOR	HIF3FB-30PA-2.54DSA	JP1

## DIGITAL BOARD

Components	DESCRIPTION	LOCATION NUMBER
IC	DHC60C31-A	U1
	74HC573	U2
	27C512	U3
	74HC138	U4,U5,U18
	74HC04	U6
	74HC574	U7,U8,U9,U10,U20,U22
	74HC245	U11,U12,U21,U24,U25

	74HC32	U13,U14,U19
	DS12887	U15
	ADSP2111	U16
	74HC393	U23
	74HC74	U26
	LM7805	U27
	6N136	U28,U29
	74HC123	U30
	TL064	U31
	AD766	U32
	TDA2030	U33
		U35
OSCILLATOR	16MHz	U17
PLEZO BUZZER	MCM1206X ,5V	U34
RESISRTOR	1 $\Omega$ 5% 250mW	R31
	10 $\Omega$ 1% 250mW	R32,R48,R49
	100 $\Omega$ 5% 250mW	R3,R34
	10K $\Omega$ 5% 250mW	R4,R8
	100K $\Omega$ 5% 250mW	R9,R21,R39,R40
	150K $\Omega$ 5% 250mW	R30
	200 $\Omega$ 1% 250mW	R10
	24K $\Omega$ 5% 250mW	R11
	30K $\Omega$ 5% 250mW	R50
	33 $\Omega$ 5% 250mW	R41,R42,R43,R44,R45,R46,R47
	4.7K $\Omega$ 5% 250mW	R2,R5,R7,R12,R13,R14,R16,R22,R36,R37,R38
	8.2K $\Omega$ 5% 250mW	R1,R23,R24,R25,R26
RESISTOR (VR )	10K $\Omega$	R15
ARRAY RESISTOR	4.7K $\Omega$ 5% 250mW 9PIN	AR1,AR2
	4.7K $\Omega$ 5% 250mW 5PIN	AR3,AR4

CAPACITOR,CERAMIC	104 10% 50V	C3,C5,C6,C8,C9,C21,C28,C29, C30,C35,C36,C43,C100,C101, C102,C103,C104,C105,C106, C107,C108,C109,C110,C111, C112,C113,C114,C115,C116, C117,C118,C119,C120,C121, C122,C123,C124,C125
	47P 10% 50V	C33,C39,C40,C41,C42,C43,C44,C45
	15P 10% 50V	C46
CAPACITOR,ELCTLT	10uF 20% 16V	C1
	100uF 20% 16V	C4,C20
	1000uF 20% 16V	C38
	1uF 20% 20V	C17,C23
	22uF 20% 20V	C22
	220uF 20% 20V	C2,C10
	2.2uF 20% 20V	C32
	47uF 20% 20V	C11
CAPACITOR,TANTAL	4.7uF 5% 25V	C7
CAPACITOR,MYLAR	104 5% 50V	C24,37
	223 5% 50V	C12
	2245% 50V	C19
	473 5% 50V	C14,C15,C16
SWITCHING DIODE	IN4148	D1,D2,D3,D4,D5,D6,D9,D10, D11,D12
DIODE	1N4001	D13,D14
TRANSISTOR	2SC1008	Q1,Q2,Q3,Q4
COIL	30uH	L1,L2
	INDUCTOR	P1,P2,P3,P4,P5,P6
CONNECTOR	5045-02P	SP1,JP3
	5045-03P	JP2
	5045-06P	JP1
	5046-08P	JP4



	HIF3FB-30PA-2.54DSA	J3
	HIF3FD-40PA-2.54DSA	J1
	HIROSE 26P	J2

# DISPLAY BOARD

Components	DESCRIPTION	LOCATION NUMBER
IC	74HC138	U1
7-SEGMENT	UD G- 304K	U3,U4
	UD G- 204A	U5
LED ARRAY	UD SR B-10	U2
LED	GREEN LED	D1,D2,D5,D6
	RED/GREEN LED	D3,D4
TRANSISTOR	2SA1525	Q1,Q2,Q3,Q4,Q5,Q6,Q7,Q8
RESISTOR	330Ω 5% 250mW	R1,R2,R3,R4,R5,R6,R7,R8,R 9, R10,R11,R12,R13,R14,R15,R 16,R17,R18,R19,R20,R21,R2 2,R23, R24,R25,,R26
SWITCH	PUSE PUTTON S/W	S1,S2,S3,S4,S5,S6,S7,S8
CONNECTOR	HIF3FB-40PA-2.54DSA	J1

## A. Appendix

( EXPLODED VIEW

( SCHEMATIC DIAGRAM

- ANALOG BOARD
- DIGITAL BOARD
- DISPLAY BOARD
- CONNECTOR BOARD
- POWER BOARD